

Robert Walter

His Book

1568/8192

T H E

Mariner's Compass

R E C T I F I E D.

*Books of NAVIGATION, &c. Printed for
W. Mount and T. Page, on Tower-Hill.*

- G**REAT-Britain's Coasting Pilot, by Capt. *Greenville Collins*.
 Coasting Pilot for *England, Scotland and Holland*.
 English Pilot for the *Channel*. English Pilot for the *Straits*.
 English Pilot for *West-India*. English Pilot for *Guinea*.
 Pilot for *East-India*. And a set of Charts for ditto.
 Sea-Atlas, containing Charts of the Sea-Coasts of the whole World.
 A compleat Set of New Charts, containing *North-Sea, Cattegat, Baltick*.
 A compleat Set of Charts for the Sea-Coast of *France*.
 The Mariner's New Kalendar, by *Nathaniel Colson*.
 The Seaman's Vademecum, or Defensive War by Sea.
 The Seaman's Practice, by *Richard Norwood*.
 Practical Navigation, or an Introduction to the Whole Art, by *J. Seller*.
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 Mariner's Compass Rectified, by *Andrew Wakely*. And enlarged by *J. A*.
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 An Epitomy of the Whole Art of Navigation, containing an easy methodical Way to become a compleat Navigator, by *James Atkinson*.
 Treatise of Trigonometry, Third Edition, by *Samuel Heynes*.
 Epitomy of Navigation, being the most useful Part of *Gillibrands, Norwood's and Jones's Works*, collated and digested into one Compendium of Navigation.
 Compendium Artis Nauticæ, by *John Collier*.
 Marine Architecture, or Directions for Building and Rigging of Ship, from the laying of her Keel to her actual going to Sea.
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 The Modern Navigator's compleat Tutor, in 2 Volumes, by *Josb. Kelley*.
 The Sector and Plain Scale compared, by *Roger Rea*.
 Description and Use of 4 several Quadrants, by *J. Collins*, and the Print
 Use of Coggerthal's Sliding Rule, the Description of *Scamoxi's Line*.

THE
Mariner's Compass
RECTIFIED:

Containing TABLES, shewing the True Hour of the Day, the Sun being upon any Point of the Compass: With the true Time of the *Rising* and *Setting* of the *Sun* and *Stars*, and the Points of the *Compass* that the *Sun* and *Stars* rise and set with: And Tables of *Amplitude*. All which Tables are Calculated from the *Equinoctial* to 60 Degrees of Latitude, &c.

With the Description and Use of those Instruments most in Use in the Art of *Navigation*. Also a TABLE of the *Latitude* and *Longitude* of Places.

By Andrew Wakely, *Math.*

Carefully Corrected, and very much Enlarged with many useful Additions.

By J. Atkinson, Teacher of the Mathematics.

L O N D O N:

Printed for William Mount and Thomas Page, on Tower-hill,
Where you may have all Sorts of Sea-Books, 1746.

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To the READER.

Courteous READER,

WHEN I first entered upon these my Labours, and after I had begun the Calculations, I found, that tho' the Book would be small, yet my Labour was so great, that I almost fainted. Yet at length, when I considered the ordinary, necessary, and frequent Use that might be made of these my Labours, I was thereby encouraged to go on and prosecute my Work; and how ready and easy I have made it for actual Performance, will plainly appear, by immediate Inspection to the meanest Capacity.

Here follows a brief Explanation of the Method and Order of the Book. First, you will find Tables of the Sun's Declination, newly calculated from the best Hypothesis yet discovered, and applied to the Meridian of London, whose Latitude is 51d. 32m. North, and Longitude according to my Table 00d. com. Next you will find Tables shewing the True Hour and Minute of the Day, the Sun being upon any Point of the Compass, which Tables are as Dials, fitting all Places in the World, whose Pole is elevated, not above 60d. either North or South. Likewise by these Tables you may know the true Hour and Minute of the Night, by the bearing of any of the known Fixed Stars between the Tropics. Then you will find Tables shewing the True Time of the Sun's Rising and Setting, with the Length of the Day and Night. Also by these Tables you may find the true Time of Rising and Setting of all the eminent Fixed Stars between the

Tropics. Next you will find Tables shewing the Points of the Compass that the Sun, and all the abovesaid Stars Rise and Set with, which Tables are of excellent Use for the ready finding of the Variation of the Compass, and may be performed by the Meridian Compass that is about ten Inches in Diameter, whose Points being divided into Halves and Quarters; such a Compass I suppose to be convenient for a Mariner's Use, where he hath not an Azimuth Compass. Next you will find Tables of Amplitudes to every Degree of the Sun's Declination: All these Tables are calculated from the Equinoctial to Sixty Degrees of Latitude, either North or South; and they will last with Exactness as long as God upholdeth the Order and Course of Nature.

In the Appendix you will find the Use of all those Instruments that are most in Use in the Art of Navigation, either for Operation, or Observation. Likewise a Table containing the most and chiefest Harbours, Headlands, and Islands in the World; shewing the Latitude and Longitude of each of them; beginning the Longitude at the Meridian of London, newly composed in a new successive Order.

This Method I own, but how I have acquitted myself therein, I shall leave to the Judgment and Experiments of the Skilfullest Mariners that the World affords, which are my native Countrymen of England.

Fare ever well, so wishes he,
Who is more yours, than he can seem to be.

Andrew Wakely.

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The Corrector to the Reader.

Candid Reader,

BEING desired by the Bookseller concerned herein, I willingly undertook the Viewing and Correcting of this Treatise, (and the rather for that respect I bear to the Memory of my Master the deceased Author) which for its Usefulness hath obtained good Esteem with our *Navigators*: I therefore have took the greater Pains, spent much Time in examining each Table, correcting, mending, altering, explaining, and enlarging where I saw Cause: Having endeavoured to render the whole of the *Mariner's Compass Rectified* most familiar, and easy to an ordinary Capacity.

In this Edition, I have contracted the *Tables of Amplitudes in Points of the Compass*, and yet as intelligible as before; by which having made more Room, I have made the *Reader* amends with large Additions in the *Use* of each Table, and methodizing the Discourse thro' out; But more especially in the *Use of Instruments*, I have taken Liberty to Repair, Alter, and Enlarge, that it will appear as good as New; but chiefly in the *Description and Use of the Gunter, Sliding-Gunter, and Sector*; principally the two former; whose *Uses* I have shew'd in *Arithmetic*, to *Multiply, Divide*, and work the *Rule of Three*; in *Geometry*, to work *Proportions, Continual, Duplicate, and Triplicate*;

Mensuration of Superficies and Solids; as to measure Board, Timber, Stone, Gauging of Vessels, Tun-
naging of Ships, Bales, or Boxes; Also in Gunnery;
in Navigation, both in Plain and Mercator's Sail-
ing: In Astronomy, the most useful Problems, As
to find the Sun's Place, Declination, Rising, Set-
ting, Amplitude, Azimuth, Hour, and Altitude
at all times. And in all, you are directed plain-
ly to perform them, both by Sliding Gunter, and
with Compasses.

In the *Table of Latitude and Longitude*, I have
added many places of Note, and omitted some
few that were of little Moment, and have corrected
both the Latitudes and Longitudes of the most Emi-
nent, according to the latest Observations: So that
I am bold to say, it's the most exact Table of it's
Kind extant.

These, with many more *Additions*, thro' the
whole, I hope will find Acceptance with Young
Students in the Mathematics, and prove service-
able to them, both in their *Studies*, and *Practice*
of Navigation, and other Parts of the *Mathema-
tics*: For whose Sakes I took the greater Pains
herein, who am an obliged Servant to teach them
what may here be wanting.

James Atkinson.

E X A C T

E X A C T

T A B L E S

Of the S U N's

DECLINATION:

R E A D E R,

BY *Observations made at distant Times, Astronomers have discovered that there is a Recession of the Equinoctial Points, which as it makes an Alteration in the Sun's Longitude, in respect to the same Point of Time from Year to Year, so it consequently makes an annual (tho' small) Variation in the Declination; And as the Latitude at Sea depends so much on the accuracy of those Tables, I have with great exactness new Calculated the same; The Table also of Lat. and Long. at the End of this Book, I have compar'd with all the various Observations I could meet with, and have Rectified (with the greatest Care) whatever I found repugnant to Superior Authority.*

WILLIAM MOUNTAINE,

Teacher of the Mathematics, in Shad-Thames,
Southwark: Young Gentlemen Boarded.

First after Leap-Year.

Sun's Declination, 1745, 1749, 1753, 1757, 1761.

Days	Januar.		Februa.		March		April		May		June	
	South		South		South		North		North		North	
1	21	36	13	34	03	10	08	49	18	14	23	12
2	21	26	13	14	02	47	09	10	18	29	23	16
3	21	15	12	53	02	23	09	32	18	43	23	19
4	21	04	12	33	01	59	09	54	18	57	23	22
5	20	53	12	12	01	35	10	15	19	11	23	24
6	20	41	11	51	01	12	10	36	19	25	23	26
7	20	29	11	30	00	48	10	57	19	38	23	27
8	20	16	11	08	00	24	11	18	19	51	23	28
9	20	03	10	47	00	01	11	38	20	04	23	29
10	19	50	10	25	Nor. 23		11	59	20	16	23	29
11	19	36	10	03	00	47	12	19	20	28	23	29
12	19	22	09	41	01	10	12	39	20	40	23	28
13	19	08	09	19	01	34	12	59	20	51	23	27
14	18	53	08	57	01	57	13	18	21	02	23	26
15	18	38	08	34	02	21	13	38	21	12	23	24
16	18	22	08	12	02	44	13	57	21	22	23	21
17	18	06	07	49	03	08	14	16	21	32	23	19
18	17	49	07	26	03	31	14	34	21	41	23	16
19	17	34	07	03	03	55	14	53	21	50	23	12
20	17	17	06	40	04	18	15	11	21	59	23	08
21	17	00	06	17	04	41	15	29	22	07	23	04
22	16	42	05	54	05	04	15	47	22	15	22	59
23	16	25	05	31	05	27	16	04	22	23	22	54
24	16	07	05	08	05	50	16	21	22	30	22	49
25	15	49	04	44	06	13	16	38	22	37	22	43
26	15	30	04	21	06	35	16	55	22	43	22	36
27	15	12	03	57	06	58	17	11	22	49	22	30
28	14	53	03	34	07	20	17	27	22	54	22	23
29	14	33			07	43	17	43	22	59	22	15
30	14	14			08	05	17	59	23	04	22	07
31	13	54			08	27			23	08		

The Mariner's Compass Rectified.

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First after Leap-Year.

Sun's Declination 1745, 1749, 1753, 1757, 1761.

Days	July		August		Septem.		October		Novem.		Decem	
	North		North		North		South		South		South	
1	21	59	14	56	04	05	07	32	17	50	23	09
2	21	51	14	38	03	42	07	54	18	06	23	13
3	21	42	14	20	03	19	08	17	18	22	23	17
4	21	32	14	01	02	56	08	39	18	37	23	20
5	21	22	13	42	02	33	09	01	18	52	23	23
6	21	12	13	23	02	10	09	23	19	07	23	25
7	21	02	13	03	01	46	09	45	19	21	23	27
8	20	51	12	44	01	23	10	07	19	35	23	28
9	20	40	12	24	01	00	10	29	19	49	23	29
10	20	29	12	04	00	36	10	50	20	03	23	29
11	20	17	11	44	00	13	11	12	20	15	23	29
12	20	04	11	24	Sou. 11		11	33	20	28	23	28
13	19	52	11	03	00	34	11	54	20	40	23	27
14	19	39	10	42	00	58	12	14	20	52	23	26
15	19	26	10	21	01	21	12	35	21	03	23	24
16	19	12	10	00	01	45	12	56	21	15	23	21
17	18	59	09	39	02	08	13	16	21	25	23	18
18	18	44	09	18	02	32	13	36	21	36	23	15
19	18	30	08	56	02	55	13	56	21	45	23	11
20	18	15	08	35	03	18	14	15	21	55	23	07
21	18	00	08	13	03	42	14	34	22	04	23	02
22	17	45	07	51	04	05	14	53	22	12	22	56
23	17	29	07	29	04	28	15	12	22	20	22	51
24	17	13	07	07	04	51	15	3	22	28	22	44
25	16	57	06	44	05	15	15	49	22	35	22	38
26	16	41	06	22	05	39	16	07	22	42	22	31
27	16	24	05	59	06	01	16	25	22	48	22	26
28	16	07	05	37	06	24	16	4	22	54	22	15
29	15	50	05	14	06	46	17	00	23	00	22	07
30	15	32	04	51	07	09	17	17	23	05	21	58
31	15	14	04	28			17	34			21	49

Second after Leap Year.

Sun's Declination, 1746, 1740, 1754, 1758, 1762.

Days	Januar.	Februa.	March	April	May	June
	South	South	South	North	North	North
1	21 39	13 39	03 16	08 43	18 10	23 11
2	21 29	13 19	02 52	09 05	18 25	23 15
3	21 08	12 58	02 28	09 27	18 40	23 18
4	21 07	12 38	02 05	09 48	18 54	23 21
5	20 56	12 17	01 41	10 10	19 08	23 23
6	20 44	11 56	01 18	10 31	19 22	23 25
7	20 32	11 35	00 54	10 52	19 35	23 27
8	20 19	11 13	00 30	11 13	19 48	23 28
9	20 06	10 52	00 06	11 33	20 01	23 29
10	19 53	10 30	Nor. 17	11 54	20 13	23 29
11	19 39	10 09	00 41	12 14	20 25	23 29
12	19 25	09 4	01 05	12 34	20 37	23 28
13	19 11	09 24	01 28	12 54	20 48	23 27
14	18 56	09 02	01 52	13 14	20 59	23 26
15	18 41	08 40	02 15	13 33	21 10	23 24
16	18 26	08 17	02 39	13 52	21 20	23 22
17	18 10	07 55	03 02	14 11	21 30	23 19
18	17 54	07 32	03 26	14 30	21 39	23 16
19	17 38	07 09	03 49	14 48	21 48	23 13
20	17 21	06 46	04 12	15 07	21 57	23 09
21	17 04	06 23	04 35	15 25	22 05	23 05
22	16 47	06 00	04 58	15 43	22 13	23 00
23	16 29	05 37	05 21	16 00	22 21	22 55
24	16 11	05 13	05 44	16 17	22 28	22 50
25	15 53	04 50	06 07	16 34	22 35	22 44
26	15 34	04 27	06 30	16 51	22 41	22 38
27	15 16	04 03	06 52	17 07	22 47	22 31
28	14 57	03 39	07 15	17 23	22 53	22 24
29	14 38		07 37	17 39	22 38	22 17
30	14 18		07 59	17 55	23 03	22 09
31	13 59		8 22		23 07	

The Mariner's Compass Rectified.

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Second after Leap-Year.

Sun's Declination, 1746, 1750, 1754, 1758, 1762.

62.

June		July		August		Septem.		October		Novem.		Decem.	
North		North		North		North		South		South		South	
3	11	1	22 01	15	01	04	11	07	26	17	46	23	08
3	15	2	21 53	14	43	03	48	07	49	18	02	23	12
3	18	3	21 44	14	24	03	25	08	11	18	18	23	16
3	21	4	21 35	14	05	03	02	08	34	18	33	23	19
3	23	5	21 25	13	47	02	39	08	56	18	49	23	22
3	25	6	21 15	13	27	02	15	09	18	19	03	23	24
3	27	7	21 05	13	08	01	53	09	40	19	18	23	26
3	28	8	20 54	12	49	01	30	10	02	19	32	23	28
3	29	9	20 43	12	29	01	05	10	23	19	46	23	28
3	29	10	20 31	12	09	00	42	10	45	19	59	23	29
3	29	11	20 20	11	49	00	18	11	06	20	12	23	29
3	28	12	20 07	11	29	Sou. 05		11	28	20	25	23	28
3	27	13	19 55	11	08	00	29	11	49	20	37	23	27
3	26	14	19 42	10	47	00	52	12	09	20	49	23	26
3	24	15	19 29	10	26	01	16	12	30	21	01	23	24
3	22	16	19 16	10	05	01	39	12	51	21	12	23	22
3	19	17	19 02	09	44	02	02	13	11	21	23	23	19
3	16	18	18 48	09	23	02	26	13	31	21	33	23	15
3	13	19	18 34	09	01	02	49	13	51	21	43	23	12
3	09	20	18 19	08	40	03	13	14	10	21	52	23	07
3	05	21	18 04	08	18	03	36	14	30	22	01	23	03
3	00	22	17 49	07	56	03	59	14	49	22	10	22	57
2	55	23	17 33	07	34	04	23	15	08	22	18	22	52
2	50	24	17 17	07	12	04	46	15	26	22	26	22	46
2	44	25	17 01	06	50	05	09	15	45	22	33	22	39
2	38	26	16 45	06	27	05	32	16	03	22	40	22	32
2	31	27	16 28	06	05	05	55	16	21	22	47	22	25
2	24	28	16 11	05	42	06	18	16	38	22	53	22	19
2	17	29	15 54	05	20	06	41	16	56	22	58	22	09
2	09	30	15 36	04	57	07	04	17	13	23	03	22	00
		31	15 19	04	34			17	30			21	51

Third after Leap-Year.

Sun's Declination 1747, 1751, 1755, 1759, 1763.

Days	Januar South	Februa. South	March South	April North	May North	June North
1	21 41	13 44	3 22	8 38	18 06	23 10
2	21 31	13 23	2 58	9 00	18 21	23 14
3	21 21	13 03	2 34	9 22	18 36	23 17
4	21 10	12 43	2 11	9 43	18 50	23 20
5	20 58	12 22	1 47	10 05	19 05	23 23
6	20 47	12 01	1 23	10 26	19 18	23 26
7	20 35	11 40	1 00	10 47	19 32	23 29
8	20 22	11 19	0 36	11 08	19 45	23 32
9	20 10	10 57	0 12	11 28	19 58	23 35
10	19 56	10 36	Nor. 12	11 49	20 10	23 38
11	19 43	10 14	0 35	12 09	20 22	23 41
12	19 29	9 52	0 59	12 29	20 34	23 44
13	19 15	9 30	1 22	12 49	20 45	23 47
14	19 00	9 08	1 46	13 09	20 56	23 50
15	18 45	8 45	2 10	13 28	21 07	23 53
16	18 30	8 23	2 33	13 48	21 17	23 56
17	18 14	8 00	2 56	14 07	21 27	23 59
18	17 58	7 37	3 20	14 25	21 37	24 02
19	17 42	7 15	3 43	14 44	21 46	24 05
20	17 25	6 52	4 07	15 02	21 55	24 08
21	17 08	6 29	4 30	15 20	22 03	24 11
22	16 51	6 05	4 53	15 38	22 11	24 14
23	16 33	5 42	5 16	15 56	22 19	24 17
24	16 16	5 19	5 39	16 13	22 26	24 20
25	15 57	4 56	6 02	16 30	22 33	24 23
26	15 39	4 32	6 24	16 47	22 40	24 26
27	15 20	4 09	6 47	17 03	22 46	24 29
28	15 02	3 45	7 09	17 20	22 52	24 32
29	14 42		7 32	17 35	22 57	24 35
30	14 23		7 54	17 51	23 02	24 38
31	14 03		8 16		23 06	24 41

Third after Leap-Year.

Sun's Declination, 1747, 1751, 1755, 1759, 1763.

1763.

June		Days	July		August		Septem.		October		Novem.		Decem.	
North			North		North		North		South		South		South	
23	10	1	22	03	15	05	04	17	07	21	17	42	23	07
23	14	2	21	55	14	47	03	54	07	43	17	58	23	11
23	17	3	21	46	14	29	03	30	08	06	18	14	23	15
23	20	4	21	37	14	10	03	07	08	28	18	30	23	18
23	23	5	21	27	13	51	02	44	08	51	18	45	23	21
23	26	6	21	17	13	32	02	21	09	13	19	00	23	24
23	29	7	21	07	13	13	01	58	09	35	19	14	23	26
23	2	8	20	56	12	53	01	34	09	57	19	29	23	27
23	5	9	20	45	12	34	01	11	10	18	19	42	23	28
23	8	10	20	34	12	14	00	47	10	40	19	56	23	29
23	11	11	20	23	11	54	00	24	11	01	20	09	23	29
23	14	12	20	11	11	34	00	01	11	22	20	22	23	29
23	17	13	19	58	11	13	Sou. 23	11	43	20	34	23	28	
23	20	14	19	46	10	52	00	46	12	04	20	46	23	26
23	23	15	19	33	10	32	01	10	12	25	20	58	23	25
23	26	16	19	19	10	11	01	33	12	46	21	09	23	22
23	29	17	19	05	09	49	01	57	13	06	21	20	23	19
23	2	18	18	51	09	28	02	20	13	26	21	30	23	16
23	5	19	18	37	09	07	02	44	13	46	21	40	23	13
23	8	20	18	22	08	45	03	07	14	06	21	50	23	08
23	11	21	18	07	08	23	03	30	14	25	21	59	23	04
23	14	22	17	52	08	02	03	54	14	44	22	08	22	59
22	17	23	17	36	07	40	04	17	15	03	22	16	22	53
22	20	24	17	21	07	17	04	40	15	22	22	24	22	47
22	23	25	17	05	06	55	05	03	15	40	22	32	22	41
22	26	26	16	49	06	33	05	26	15	59	22	39	22	34
22	29	27	16	32	06	10	05	49	16	17	22	45	22	27
22	2	28	16	15	05	48	06	12	16	34	22	51	22	19
22	5	29	15	58	05	25	06	35	16	52	22	57	22	11
22	8	30	15	41	05	02	06	58	17	09	23	02	22	02
22	11	31	15	23	04	40			17	26			21	53

Leap-Year.

Sun's Declination 1748, 1752, 1756, 1760, 1764.

Days	<i>Januar</i>		<i>Februa</i>		<i>March</i>		<i>April</i>		<i>May</i>		<i>June</i>	
	South		South		South		North		North		North	
1	21	43	13	49	3	04	8	55	18	18	23	13
2	21	53	13	28	2	40	9	17	18	33	23	17
3	21	23	13	08	2	16	9	38	18	47	23	20
4	21	12	12	48	1	53	9	59	19	01	23	22
5	21	01	12	27	1	29	10	21	19	15	23	24
6	20	49	12	06	1	05	10	42	19	29	23	26
7	20	38	11	45	0	42	11	03	19	42	23	28
8	20	25	11	24	0	18	11	23	19	55	23	28
9	20	13	11	02	Nor. 05		11	44	20	07	23	29
10	20	00	10	41	0	29	12	04	20	19	23	29
11	19	46	10	19	0	53	12	25	20	31	23	29
12	19	32	9	57	1	17	12	44	20	43	23	28
13	19	18	9	35	1	40	13	04	20	54	23	27
14	19	03	9	13	2	04	13	24	21	05	23	25
15	18	49	8	51	2	27	13	43	21	15	23	23
16	18	33	8	28	2	51	14	02	21	25	23	21
17	18	18	8	06	3	14	14	21	21	35	23	18
18	18	02	7	43	3	38	14	40	21	44	23	15
19	17	46	7	20	4	01	14	58	21	53	23	11
20	17	29	6	57	4	24	15	16	22	01	23	07
21	17	12	6	34	4	47	15	34	22	10	23	03
22	16	55	6	11	5	10	15	52	22	17	22	58
23	16	38	5	48	5	33	16	09	22	25	22	53
24	16	20	5	25	5	56	16	26	22	32	22	47
25	16	02	5	01	6	19	16	43	22	38	22	41
26	15	44	4	38	6	42	16	59	22	45	22	35
27	15	26	4	14	7	04	17	16	22	50	22	28
28	15	09	3	51	7	26	17	32	22	56	22	21
29	14	47	3	27	7	49	17	47	23	01	22	13
30	14	28			8	11	18	03	23	05	22	05
31	14	08			8	33			23	10		

Leap-Year.

Sun's Declination 1748, 1752, 1756, 1760, 1764.

64.

June

North

13
17
20
22
24
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28
27
25
23
21
18
15
11
07
03
58
53
47
41
35
28
21
13
05

Days	July North	August North	Septem North	October South	Novem. South	Decem. South
1	21 57	14 51	3 59	7 38	17 54	23 10
2	21 48	14 33	3 36	8 00	18 10	23 14
3	21 39	14 15	3 13	8 23	18 26	23 18
4	21 30	13 56	2 50	8 45	18 41	23 21
5	21 20	13 37	2 27	9 07	18 56	23 23
6	21 10	13 17	2 03	9 29	19 11	23 25
7	20 59	12 58	1 40	9 51	19 25	23 27
8	20 48	12 38	1 17	10 13	19 39	23 28
9	20 37	12 19	0 53	10 35	19 53	23 29
10	20 25	11 59	0 30	10 56	20 06	23 29
11	20 13	11 38	0 06	11 17	20 19	23 29
12	20 01	11 18	Sou. 17	11 38	20 31	23 28
13	19 48	10 57	0 41	11 59	20 43	23 27
14	19 36	10 37	1 04	12 20	20 55	23 25
15	19 22	10 16	1 28	12 41	21 06	23 23
16	19 09	9 55	1 51	13 01	21 17	23 20
17	18 55	9 33	2 14	13 21	21 28	23 17
18	18 41	9 12	2 38	13 41	21 38	23 14
19	18 26	8 50	3 01	14 01	21 48	23 10
20	18 11	8 29	3 25	14 20	21 57	23 05
21	17 56	8 07	3 48	14 39	22 06	23 00
22	17 41	7 45	4 11	14 59	22 14	22 55
23	17 25	7 23	4 35	15 17	22 22	22 49
24	17 09	7 01	4 58	15 36	22 30	22 42
25	16 53	6 38	5 21	15 54	22 37	22 36
26	16 36	6 16	5 44	16 12	22 44	22 28
27	16 19	5 53	6 07	16 30	22 50	22 21
28	16 02	5 31	6 30	16 47	22 56	22 13
29	15 45	5 08	6 53	17 05	23 01	22 04
30	15 27	4 45	7 15	17 22	23 06	21 55
31	15 09	4 22		17 38		21 46

*A Description of the TABLES of the
Sun's Declination.*

TH E S E *Tables* are in General for four Years; *Leap-Year, First, Second, and Third Year* after *Leap-Year*; and consequently for any Year.

Each Year (taking up two Pages) hath the first six Months of the Year on the Left-hand Page, and the last six Months are on the Right-hand Page; the Names of the Months are at the Head of each Column, and the Days of each Month in the Left-hand Column of each Page.

The first Table sheweth the Sun's *Declination* every Day for the first Years after Leap-Year being 1745, 1749, 1753, 1757, 1761, &c. and takes up Pages (10) and (11): The second Table is for 1746, 1750, 1754, 1758, 1762, &c. being Second Years after Leap-Year in Pages (12) and (13): The next Table in Pages (14) and (15) is for the Third Years after Leap-Year: The fourth Table in Pages (16) and (17) sheweth the Sun's *Declination* for Leap-Years, being 1748, 1752, 1756, 1760, 1764, &c.

Under the Name of the Month, is the Name of the *Declination*, either North or South: only the Column for *March* and *September*, hath two Names; that is, under *March* is *South*, and against the 10th Day is *Nor.* for *North*; and under *September* is *North*, and against the 12th or 13th Day is *Sou.* for *South*; intimating the *Declination* is *South* in *March*, till the 10th Day, and all the remaining part of the Month it's *Nor.* or *North*; in like manner in *September*, it's *North* till the 12th or 13th Day, and from thence to the Months end it's *Sou.* or *South*.

The Use of the Tables of Declination.

TO find the Sun's Declination for any Day in any Year, is after this manner.

1. Seek the Year and Month, at the Head of the Table; and the Day of the Month in the Left hand Column.

2. Then right under the Month, at the Head of the Table, and against the Day of the Month in the Left-hand Column, is the Sun's Declination required.

Example 1. I desire to know the Sun's Declination for the 24th Day of *April*, 1745.

The Year 1745, is the First Year after Leap-Year which is in Page (10); then under *April*, and against 24 (under Days) is 16.21, with North at the Head of the Table under *April*; which sheweth the Sun's Declination on the 24th of *April* 1745, is 16d. 21m. North.

Example 2. What is the Sun's Declination for the 10th of *March* 1748.

The Year 1748, being Leap-Year is found in Page 16; then against the 10th Day and under *March*, is *Nor.* 0.29; signifying the Sun's Declination at that time, is 00 d. 29 m. North; the like do for any other Time.

A Table to Proportion the Sun's Declination to any other Meridian.

East West } Long. with Decl.	Degrees of Longitude.	The Daily difference in Declination.											
		m	m	m	m	m	m	m	m	m	m	m	m
		2	4	6	8	10	12	14	16	18	20	22	24
		1	1	1	1	1	1	1	1	1	1	1	1
		0	0	0	0	0	0	1	1	1	1	1	1
		0	0	0	1	1	1	1	1	1	2	2	2
		0	0	1	1	1	1	2	2	2	2	3	3
		0	1	1	1	2	2	2	3	3	3	4	4
		0	1	1	2	2	2	3	3	4	4	5	5
		0	1	1	2	2	3	3	4	4	5	5	6
		1	1	2	2	3	3	4	5	5	6	6	7
		1	1	2	3	3	4	5	5	6	7	7	8
		1	1	2	3	4	4	5	6	7	7	8	9
		1	2	2	3	4	5	6	7	7	8	9	10
		1	2	3	4	5	5	6	7	8	9	10	11
		1	2	3	4	5	6	7	8	9	10	11	12

The Use of this Table of Proportion.

THE Tables of the Sun's Declination are calculated for the Meridian of *London*, and will serve any Place under that Meridian; but for those Places situate Easterly or Westerly from it, the Declination must be proportioned according to its daily Difference in the Table, and Longitude of those Places from the Meridian of *London*; for which Purpose this Table is useful, and it's evident by these Examples following.

Example

Example 1.

Admit the 10th Day of April, Anno 1748, I am in Longitude 105 d. East; I demand what Declination the Sun will have that Day in the Meridian of that Place?

The Declination for April the 10th, in the Meridian of London is 12d. 04m. increasng, and the daily Difference at that time, is 21m. therefore in this Table look in the Head thereof for the nearest Number to 21m. which is 20m. then look on the Left-hand of the Table for 105 deg. the Longitude I am in, and in the common Angle of meeting is 6 min. which is to be deducted from the Declination in the Meridian of London aforesaid, 12 deg. 04 min. and the Remainder will be the Declination for that Meridian, or the Longitude I am in, which is 11 d. 58m. North. But if the Declination had decreased, as it doth here increase, then you must have added, as here under you may see.

	d.	m.
The Declination in the Meridian of London is—	12	04 N
The proportional minutes subtract ————	00	06
The Decl. for the Longitude of 105d. E. is—	11	58 N
The Declin. for the Longitude of 105d. West—	12	10 N

Example 2.

Admit the 10th Day of October, Anno 1746. I am in Longitude 87d. West, I demand what Declination the Sun will have that Day in that Meridian?

The daily difference in the Table of Declination, at this Time is 21m. and the proportional Part thereof by the last Table is 5m. increasng.

	d.	m.
The Declination in the Meridian of London—	10	45 S
The proportional minutes add ————	00	05
The Declination in the Long. of 87d. West is—	10	50 S
The Declin. for the Longitude of 87d. East is—	10	40 S

A Table of Refractions deduced from Mr. Flamsteed's Observations, made at the Royal Observatory at Greenwich.

Altitudes.	Refractions	Altitudes	Refractions	Altitudes	Refractions	Altitudes	Refractions
D.	M. S.	D.	M. S.	D.	M. S.	D.	M. S.
00	33.00	10	4.33	25	1.45	40	0.58
00 $\frac{1}{2}$	26.38	11	4.06	26	1.40	41	0.56
01	23.22	12	3.45	27	1.36	42	0.54
01 $\frac{1}{2}$	20.17	13	3.29	28	1.31	43	0.52
02	17.26	14	3.13	29	1.27	44	0.50
02 $\frac{1}{2}$	15.15	15	3.00	30	1.23	45	0.48
03	13.23	16	2.48	31	1.20	46	0.46
03 $\frac{1}{2}$	11.53	17	2.38	32	1.17	47	0.45
04	10.39	18	2.29	33	1.14	48	0.44
04 $\frac{1}{2}$	9.38	19	2.21	34	1.11	49	0.42
05	8.48	20	2.14	35	1.09	50	0.40
05 $\frac{1}{2}$	7.26	21	2.07	36	1.07	55	0.34
07	6.25	22	2.01	37	1.05	60	0.29
08	5.37	23	1.55	38	1.02	70	0.19
09	5.02	24	1.50	39	1.00	80	0.09
10	4.33	25	1.45	40	0.58	90	0.00

The Refraction of the *Sun*, *Moon*, and *Stars*, causeth them to appear higher above the *Horizon* than they are; therefore the Refraction is always to be subtracted from the *Altitude* observed, that the true *Altitude* may be had.

As, admit the Sun's Meridian Altitude, by Observation, to be 5 degrees, I demand the true Altitude?

d. m.

Altitude by Observation being ———— 05 00

Sun's Refraction, subtract ———— 00 09

The Sun's true Meridian Altitude is ———— 04 51

*

Primum

PRIMUM MOBILE:

O R

Astronomical Tables ;

Each TABLE being

A SUN-DIAL ;

S H E W I N G

The exact Hour of the Day, the Sun being upon any Point of the Compass, fitting all Places upon the Earth and Sea, that lie between the Equinoctial and 60 Degrees of Latitude, either North or South : And to last with Exactness as long as the Great and Everlasting Creator shall be pleased to hold together the Great and Wonderful Fabric of Nature.

A Sun-Dial for the Latitude of 0 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
North	12	12	12	12	12	12	12	12	12	12	12
n by w		0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.17	0.19	0.20
n n w		0.04	0.08	0.12	0.17	0.21	0.25	0.30	0.35	0.39	0.41
n n w by n		0.07	0.13	0.20	0.27	0.34	0.41	0.49	0.56	1.03	1.07
n w		0.10	0.20	0.30	0.41	0.51	1.02	1.14	1.25	1.35	1.43
n a b w		0.15	0.30	0.45	1.01	1.18	1.35	1.53	2.12	2.29	2.42
w n w		0.24	0.49	1.14	1.41	2.09	2.41	3.18	4.06	5.11	
w by n		0.51	1.44	2.46	4.10						
West											
(.) let	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	2.30	5.00	7.30	10.0	12.30	15.0	17.30	20.0	22.0	23.29

South Declination.

[illegible]

A Sun-Dial for the Latitude of 2 Degrees.

North Declination.

Deg Min.	2 d 3cm	5 d 3cm	7 d 3cm	10 d 3cm	12 d 3cm	15 d 3cm	17 d 3cm	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12 North	12	12	12	12	12	12	12	12	12	12
0.02 n by w		0.02	0.04	0.07	0.09	0.11	0.13	0.15	0.17	0.18
0.04 n n w		0.05	0.09	0.13	0.18	0.22	0.27	0.32	0.36	0.38
0.06 n w b n		0.08	0.15	0.22	0.29	0.36	0.43	0.51	0.57	1.00
0.08 n w		0.12	0.22	0.33	0.43	0.54	1.05	1.17	1.27	1.38
0.12 n w b w		0.18	0.33	0.50	1.05	1.22	1.40	2.00	2.16	2.38
0.16 w n w		0.29	0.55	1.21	1.50	2.21	2.58	3.45	4.46	
0.40 w by n		1.03	2.03	3.23						
6.00 West										
0.00 ☉ set	6.00	6.00	6.01	6.01	6.02	6.02	6.02	6.03	6.03	6.04
d m Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
0 00 Ampl.	2.30	5.00	7.30	10.0	12.30	15.0	17.31	20.1	22.1	23.8

South Declination.

Deg. Min.	2 d 3cm	5 d 3cm	7 d 3cm	10 d 3cm	12 d 3cm	15 d 3cm	17 d 3cm	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12
s by w	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20
s s w	0.03	0.07	0.12	0.16	0.20	0.25	0.29	0.34	0.38	0.42
s w by s	0.05	0.12	0.19	0.25	0.32	0.39	0.46	0.54	1.01	1.08
s w	0.08	0.18	0.28	0.38	0.49	0.59	1.10	1.21	1.33	1.43
s w by w	0.12	0.27	0.42	0.57	1.13	1.29	1.46	2.04	2.24	2.40
w s w	0.19	0.43	1.08	1.33	2.00	2.28	3.00	3.36	4.24	5.24
w by s	0.40	1.30	2.22	3.22	4.43					
West	6.00									
☉ set	6.00	6.00	5.59	5.59	5.58	5.58	5.58	5.57	5.57	5.55

A Sun-Dial for the Latitude of 3 Degrees.

North Declination.

2 d	23 d	Deg.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		Min.	30m		30m		30m		30m			29m
h m	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	12	North	12	12	12	12	12	12	12	12	12	12
0.17	0.1	n by w	Zen. West	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18
0.36	0.3	n nw		0.03	0.07	0.12	0.16	0.21	0.25	0.30	0.34	0.37
0.57	1.0	n w by n		0.05	0.12	0.19	0.26	0.33	0.40	0.48	0.54	0.59
1.27	1.3	n w		0.08	0.18	0.29	0.39	0.50	1.01	1.13	1.23	1.31
2.16	2.3	n w by w		0.12	0.27	0.43	0.59	1.16	1.34	1.54	2.10	2.24
4.46		w n w		0.20	0.45	1.11	1.39	2.11	2.47	3.33	4.33	
		w by n		0.42	1.40	2.57						
		West										
6.03	6.0	let	6.00	6.00	6.01	6.02	6.02	6.03	6.04	6.04	6.05	6.05
h m	d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
22.1	23.3	Ampl	2.30	5.00	7.30	10.1	12.31	15.1	17.31	20.2	22.2	23.31

South Declination.

2 d	23 d	Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		Min.		30m		30m		30m		30m			29m
h m	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	12	South	12	12	12	12	12	12	12	12	12	12	12
0.20	0.2	s by w	0.02	0.04	0.06	0.08	0.10	0.13	0.15	0.17	0.19	0.21	0.22
0.42	0.4	s s w	0.05	0.09	0.13	0.18	0.22	0.26	0.31	0.35	0.40	0.44	0.47
1.08	1.1	s w by s	0.08	0.15	0.21	0.28	0.35	0.42	0.49	0.56	1.04	1.10	1.11
1.43	1.5	s w	0.12	0.22	0.32	0.42	0.53	1.03	1.14	1.25	1.37	1.47	1.55
2.40	2.5	w by w	0.18	0.33	0.48	1.05	1.19	1.35	1.52	2.10	2.30	2.45	3.00
5.24		w s w	0.29	0.53	1.17	1.42	2.09	2.37	3.08	3.43	4.31	5.29	
		w by s	0.59	1.48	2.40	3.38	4.55						
		West	6.00										
5.57	5.5	let	5.00	6.00	6.00	5.59	5.58	5.58	5.57	5.56	5.56	5.55	5.55

A Sun-Dial for the Latitude of 4 Degrees.

North Declination.

Deg. Min.	2 d 30m	Deg. Min.	5 d 30m	7 d 30m	10 d 30m	12 d 30m	15 d 30m	17 d 30m	20 d 30m	22 d 30m	23 d 29m
Point	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	North	12	12	12	12	12	12	12	12	12
s by w	0.01	n by w	0.01	0.03	0.05	0.07	0.09	0.11	0.13	0.15	0.17
s s w	0.02	n n w	0.02	0.06	0.10	0.14	0.19	0.23	0.28	0.32	0.37
sw by s	0.04	nawbyn	0.03	0.09	0.16	0.23	0.30	0.38	0.45	0.52	0.57
s w	0.06	n w	0.04	0.12	0.24	0.35	0.46	0.57	1.09	1.19	1.27
swbw	0.09	nwbw	0.05	0.21	0.37	0.53	1.10	1.28	1.47	2.04	2.17
w s w	0.14	wnw	0.10	0.35	1.01	1.29	2.00	2.36	3.21	4.17	
w by s	0.29	wbn	0.21	1.17	2.29						
West	3.25	West									
☉ fet	6.00	☉ fet	6.01	6.02	6.03	6.03	6.04	6.05	6.06	6.06	6.07
Sun's d m		Sun's d m									
Ampl	2.20	Ampl	5.00	7.31	10.1	12.31	15.2	17.32	20.3	22.3	23.31

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.03	0.05	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22	0.23
s s w	0.07	0.11	0.15	0.19	0.23	0.28	0.32	0.36	0.41	0.45	0.48
sw by s	0.11	0.17	0.24	0.31	0.38	0.45	0.52	0.59	1.07	1.13	1.18
s w	0.16	0.26	0.36	0.46	0.57	1.07	1.18	1.29	1.41	1.51	1.59
swbyw	0.24	0.39	0.54	1.09	1.25	1.41	1.58	2.16	2.35	2.51	3.05
w s w	0.38	1.02	1.26	1.51	2.17	2.45	3.17	3.52	4.38	5.33	
w by s	1.17	2.05	2.55	3.51	5.04						
West.	6.00										
☉ fet	6.00	6.00	5.59	5.58	5.57	5.57	5.56	5.55	5.54	5.54	5.53

A Sun-Dial for the Latitude of 5 Degrees.

North Declination.

Deg. Min.	2 0	Deg. Min.	3 0	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	North	12	12	12	12	12	12	12	12	12
s by w	0.02	n by w	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	
s s w	0.04	n n w	0.04	0.08	0.13	0.17	0.22	0.26	0.30	0.33	
sw by s	0.07	nw by n	0.07	0.14	0.21	0.28	0.35	0.43	0.49	0.54	
s w	0.10	n w	0.10	0.20	0.31	0.42	0.53	1.05	1.15	1.22	
sw by w	0.16	nw by w	0.15	0.31	0.47	1.04	1.21	1.40	1.57	2.10	
w s w	0.24	w n w	0.25	0.51	1.18	1.49	2.24	3.08	4.00		
w by s	0.48	w by n	0.54	2.01							
West	4.00	West									
☉ fet	6.01	☉ fet	6.02	6.03	6.04	6.04	6.05	6.06	6.07	6.08	6.09
Sun's d m	2.30	Sun's d m	5.01	7.31	10.2	12.32	15.3	17.34	20.5	22.5	23.35
Amp.		Ampl.									

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24
s s w	0.08	0.12	0.17	0.21	0.25	0.29	0.34	0.38	0.43	0.47	0.50
sw by s	0.13	0.20	0.27	0.33	0.40	0.47	0.54	1.02	1.09	1.16	1.21
s w	0.20	0.30	0.40	0.50	1.00	1.11	1.22	1.33	1.45	1.55	2.02
sw by w	0.30	0.45	1.00	1.15	1.31	1.46	2.03	2.21	2.40	2.56	3.11
w s w	0.48	1.11	1.35	2.00	2.26	2.53	3.24	3.59	4.43	5.37	
w by s	1.35	2.21	3.09	4.03	5.11						
West	6.00										
☉ fet	6.00	5.59	5.58	5.57	5.56	5.56	5.55	5.54	5.53	5.52	5.51

A Sun-Dial for the Latitude of 6 Degrees.

North Declination.

Deg.	2	0	5	d	Deg.	7	d	10	d	12	d	15	d	17	d	20	d	22	d	23	d
Min.	30m				Min.	30m				30m				30m						29m	
Point	h	m	h	m	Point	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
South	12	12			North	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
s by w	0.03	0.01			n by w	0.01	0.03	0.05	0.07	0.09	0.12	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31
s s w	0.06	0.02			n n w	0.03	0.07	0.11	0.15	0.20	0.25	0.28	0.31	0.34	0.37	0.40	0.43	0.46	0.49	0.51	0.54
sw by s	0.09	0.03			nwb yn	0.04	0.11	0.18	0.25	0.32	0.40	0.46	0.51	0.57	0.62	0.67	0.72	0.77	0.82	0.87	0.91
s w	0.14	0.04			n w	0.06	0.16	0.27	0.38	0.49	1.01	1.10	1.18	1.27	1.34	1.42	1.50	1.58	1.66	1.74	1.82
sw by w	0.21	0.06			nwb w	0.09	0.25	0.41	0.57	1.15	1.34	1.50	2.04	2.19	2.34	2.49	2.64	2.79	2.94	3.09	3.24
w s w	0.33	0.09			w n w	0.15	0.40	1.18	1.38	2.12	2.55	3.44	4.33	5.22	6.11	7.00	7.89	8.78	9.67	10.56	11.45
w by s	1.06	0.20			w by n	0.32	1.34	3.24													
West	4.22	2.15			West																
☉ set	6.01	6.02			☉ set	6.03	6.04	6.05	6.06	6.07	6.09	6.10	6.11	6.12	6.13	6.14	6.15	6.16	6.17	6.18	6.19
Sun's d m	d m	d m			Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl. 2	30	5.01			Ampl. 7	22	10	3	12.34	15	5	17.36	20	6	22.7	23.37					

South Declination.

Deg.	0	d	2	d	5	d	7	d	10	d	12	d	15	d	17	d	20	d	22	d	23	d
Min.			30m				30m				30m				30m						29m	
Point	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
South	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
s by w	0.00	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.46
s s w	0.10	0.14	0.18	0.22	0.27	0.31	0.35	0.40	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.69	0.72	0.75	0.78	0.81	0.84
sw by s	0.16	0.23	0.29	0.36	0.43	0.50	0.57	1.04	1.12	1.18	1.23	1.29	1.34	1.40	1.46	1.51	1.57	1.62	1.68	1.73	1.79	1.84
s w	0.24	0.34	0.44	0.54	1.04	1.15	1.25	1.37	1.48	1.58	2.06	2.14	2.22	2.30	2.38	2.46	2.54	2.62	2.70	2.78	2.86	2.94
sw by w	0.36	0.50	1.05	1.20	1.36	1.52	2.08	2.26	2.45	3.01	3.15	3.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	4.50	4.65	4.80
w s w	0.57	1.20	1.44	2.08	2.34	3.01	3.31	4.06	4.48	5.37												
w by s	1.51	2.35	3.22	4.13	5.16																	
West	6.00																					
☉ set	6.00	5.59	5.58	5.57	5.56	5.55	5.54	5.53	5.51	5.50	5.49	5.48	5.47	5.46	5.45	5.44	5.43	5.42	5.41	5.40	5.39	5.38

A Sun-Dial for the Latitude 7 of Degrees.

North Declination.

Deg.	2 d	5 d	Deg.	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		Min.	30m		30m		30m			29m
Point	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	North	12	12	12	12	12	12	12	12
s by w	0.04	0.02	n by w	0.00	0.02	0.04	0.07	0.09	0.11	0.13	0.14
s s w	0.07	0.03	n n w	0.01	0.05	0.09	0.14	0.18	0.23	0.27	0.30
sw by s	0.12	0.05	nw by n	0.01	0.08	0.15	0.22	0.29	0.37	0.44	0.48
s w	0.18	0.08	n w	0.02	0.12	0.23	0.33	0.45	0.56	1.06	1.14
sw by w	0.27	0.12	nw by w	0.03	0.18	0.34	0.51	1.08	1.27	1.43	1.57
w s w	0.43	0.19	w n w	0.05	0.30	0.57	1.27	2.00	2.42	3.28	
w by s	1.23	0.39	w by n	0.10	1.08	2.36					
West	4.37	2.58	West								
☉ set	6.01	6.02	☉ set	6.03	6.05	6.06	6.08	6.09	6.10	6.11	6.12
Sun's	d m	d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	2.31	5.01	Ampl.	7.33	10.4	12.35	15.7	17.38	20.	22.10	23.40

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m			30m			30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.06	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22	0.24	0.25
s s w	0.12	0.16	0.20	0.24	0.28	0.33	0.37	0.41	0.46	0.50	0.53
sw by s	0.19	0.25	0.32	0.39	0.45	0.52	0.59	1.07	1.15	1.21	1.25
s w	0.28	0.38	0.48	0.58	1.08	1.18	1.29	1.40	1.52	2.02	2.09
sw by w	0.41	0.56	1.11	1.26	1.41	1.57	2.14	2.31	2.50	3.05	3.19
w s w	1.06	1.29	1.52	2.16	2.41	3.08	3.38	4.12	4.52	5.39	
w by s	2.06	2.49	3.33	4.22	5.20						
West	6.06										
☉ set	6.00	5.59	5.58	5.57	5.55	5.54	5.52	5.51	5.50	5.40	5.48

A Sun-Dial for the Latitude of 8 Degrees.

North Declination.

Deg. Min.	2 d	5 d	7 d	Deg. Min.	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	North	12	12	12	12	12	12	12
s by w	0.04	0.02	0.00	n by w	0.02	0.04	0.06	0.08	0.10	0.12	0.13
s s w	0.09	0.05	0.01	n n w	0.03	0.08	0.12	0.16	0.21	0.25	0.28
sw by s	0.15	0.06	0.01	nw by n	0.05	0.12	0.20	0.27	0.34	0.41	0.45
s w	0.22	0.12	0.02	n w	0.08	0.18	0.29	0.40	0.52	1.02	1.00
sw by w	0.33	0.18	0.03	nwb w	0.12	0.28	0.45	1.02	1.20	1.35	1.49
w s w	0.52	0.29	0.05	w n w	0.20	0.46	1.16	1.48	2.28	3.11	4.07
w by s	1.39	0.56	0.10	w by n	0.44	1.59					
West	4.48	3.26	1.22	West							
☉ set	6.01	6.03	6.04	☉ set	6.06	6.07	6.09	6.10	6.12	6.13	6.15
Sun's d	d m	d m	d m	Sun's d	d m	d m	d m	d m	d m	d m	d m
Ampl	2.31	5.02	7.34	Ampl	10.6	12.38	15.0	17.40	20.12	22.13	23.43

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.21	0.23	0.25	0.26
s s w	0.13	0.17	0.21	0.26	0.30	0.34	0.38	0.43	0.47	0.51	0.54
sw by s	0.21	0.28	0.34	0.41	0.48	0.55	1.02	1.09	1.17	1.23	1.28
s w	0.32	0.41	0.51	1.01	1.11	1.22	1.33	1.44	1.55	2.05	2.13
sw by w	0.47	1.02	1.16	1.31	1.46	2.02	2.19	2.36	2.55	3.09	3.22
w s w	1.14	1.37	2.00	2.24	2.48	3.15	3.44	4.17	4.56	5.39	
w by s	2.20	3.01	3.44	4.30	5.24						
West	6.00										
☉ set	6.00	5.59	5.57	5.56	5.54	5.53	5.52	5.50	5.48	5.47	5.46

A Sun-Dial for the Latitude of 9 Degrees.

North Declination.

Deg. Min.	2 d	5 d	7 d	Deg. Min.	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	North	12	12	12	12	12	12	12
by w	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07	0.09	0.11	0.12
s w	0.11	0.07	0.03	n n w	0.02	0.06	0.10	0.14	0.19	0.23	0.26
sw by s	0.17	0.11	0.04	n w by n	0.03	0.10	0.17	0.24	0.31	0.38	0.43
s w	0.26	0.16	0.06	n w	0.04	0.14	0.25	0.36	0.47	0.57	1.05
sw by w	0.38	0.24	0.09	n w by w	0.06	0.22	0.38	0.55	1.13	1.30	1.42
w s w	1.00	0.38	0.14	w n w	0.10	0.36	1.04	1.36	2.15	2.55	3.42
w by s	2.53	1.13	0.29	w by n	0.21	1.27					
West	4.56	3.46	2.15								
☉ fet	6.01	5.03	6.04	☉ fet	6.06	5.08	6.10	6.12	6.14	6.15	6.16
Sun's	d m	d m	d m	Sun's	d m	d m	d m	d m	d m	d m	d m
Ampl	2.31	5.03	7.35	Ampl	1.7	12.39	15.11	17.43	20.16	22.18	23.50

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h n	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.24	0.25	0.27
s w	0.15	0.19	0.23	0.27	0.31	0.36	0.40	0.44	0.49	0.52	0.56
sw by s	0.24	0.30	0.37	0.44	0.50	0.57	1.04	1.12	1.19	1.25	1.31
s w	0.36	0.45	0.55	1.05	1.15	1.26	1.36	1.47	1.59	2.09	2.16
sw by w	0.53	1.07	1.22	1.36	1.52	2.07	2.24	2.41	2.59	3.14	3.28
w s w	1.23	1.45	2.08	2.31	2.55	3.21	3.50	4.22	5.00	5.40	
w by s	2.33	3.12	3.53	4.36	5.27						
West	6 00										
☉ fet	6 00	5.59	5.57	5.56	5.54	5.52	5.50	5.48	5.46	5.45	5.44

A Sun-Dial for the Latitude of 10 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	Deg.	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m			30m	Min.	30m		30m			20m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0.06	0.04	0.02	Zen. West	n by n	0.02	0.04	0.06	0.08	0.10	0.12
s s w	0.12	0.08	0.04		n n w	0.04	0.09	0.13	0.18	0.21	0.24
sw by s	0.20	0.13	0.07		n w b w	0.07	0.14	0.21	0.29	0.35	0.40
s w	0.30	0.20	0.10		n w	0.10	0.21	0.32	0.43	0.53	1.00
sw b w	0.44	0.30	0.15		n w b n	0.15	0.32	0.49	1.06	1.23	1.35
w s w	1.09	0.47	0.24		w n w	0.25	0.53	1.24	2.01	2.39	3.19
w by s	2.07	1.28	0.47		w b n	0.59	3.07				
West	5.03	4.01	2.47								
☉ set	6.02	6.04	6.05	6.07	☉ set	6.09	6.11	6.13	6.15	6.16	6.17
Sun's d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m	d m	d m	d m
Ampl	2.22	5.05	7.27	10.10	Ampl.	12.42	15.15	17.47	20.20	22.22	24.51

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.27
s s w	0.16	0.21	0.25	0.29	0.33	0.37	0.42	0.46	0.51	0.54	0.57
sw by s	0.26	0.33	0.40	0.46	0.53	1.00	1.07	1.14	1.22	1.28	1.33
s w	0.39	0.49	0.59	1.09	1.19	1.29	1.40	1.51	2.02	2.12	2.19
sw by w	0.58	1.13	1.27	1.42	1.57	2.12	2.28	2.45	3.03	3.19	3.23
w s w	1.31	1.53	2.15	2.38	3.02	3.27	3.55	4.36	5.03	5.41	
w by s	2.44	3.22	4.01	4.42	5.29						
West.	6.00										
☉ set	6.00	5.58	5.56	5.55	5.53	5.51	5.49	5.47	5.45	5.44	5.43

A Sun-Dial for the Latitude of 11 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	Deg.	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		Min.	30m		30m			29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0.07	0.05	0.03	0.01	n by n	0.01	0.03	0.05	0.07	0.09	0.11
s s w	0.14	0.10	0.07	0.02	n n w	0.02	0.07	0.11	0.16	0.20	0.22
sw by s	0.22	0.16	0.09	0.03	nw by n	0.04	0.11	0.18	0.26	0.32	0.37
s w	0.34	0.24	0.14	0.04	n w	0.06	0.17	0.28	0.39	0.49	0.56
sw by w	0.50	0.35	0.21	0.06	nwb w	0.09	0.25	0.42	1.00	1.15	1.28
w s w	1.17	0.56	0.33	0.08	w n w	0.15	0.41	1.12	1.47	2.23	2.59
w by s	2.19	1.43	1.03	0.20	w by n	0.33	1.55				
West	5.08	4.13	3.09	1.40							
☉ fet	5.02	6.04	6.06	5.08	☉ fet	6.10	6.12	6.14	6.16	6.18	6.19
Sun's d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m	d m	d m	d m
Ampl	2.32	5.05	2.38	10.11	Ampl	12.44	15 17	17.50	20.24	22 27	23.59

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.28
s s w	0.18	0.22	0.26	0.30	0.34	0.39	0.43	0.47	0.52	0.56	0.59
sw by s	0.29	0.36	0.42	0.49	0.55	1.02	1.09	1.16	1.24	1.30	1.35
s w	0.43	0.53	1.03	1.12	1.22	1.33	1.43	1.54	2.05	2.15	2.22
sw by w	1.04	1.18	1.32	1.47	2.01	2.17	2.33	2.49	3.07	3.23	3.35
w s w	1.39	2.01	2.22	2.45	3.08	3.33	4.00	4.30	5.05	5.41	
w by s	2.55	3.31	4.08	4.47	5.31						
West	6.00										
☉ fet	6.00	5.58	5.56	5.54	5.52	5.50	5.48	5.46	5.44	5.42	5.41

A Sun-Dial for the Latitude of 12 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	Deg.	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		Min.	30m		30m			29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0.07	0.06	0.04	0.02	n by w	0.00	0.02	0.04	0.07	0.09	0.10
s s w	0.16	0.12	0.08	0.04	n n w	0.01	0.05	0.10	0.14	0.18	0.21
sw by s	0.25	0.19	0.12	0.05	nw by n	0.01	0.08	0.15	0.23	0.29	0.34
s w	0.37	0.28	0.18	0.08	n w	0.02	0.12	0.23	0.35	0.44	0.51
sw by w	0.55	0.41	0.27	0.12	nwb w	0.03	0.19	0.35	0.53	1.09	1.21
w s w	1.25	1.04	0.42	0.19	w n w	0.05	0.31	1.00	1.34	2.07	2.40
w by s	2.31	1.56	1.19	0.38	w by n	0.09	1.17				
West	5.12	4.23	3.27	2.16							
☉ set	6.02	6.04	6.06	6.09	☉ set	6.11	6.13	6.15	6.18	6.20	6.21
Sun's d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m	d m	d m	d m
Ampl.	2.33	5.07	7.30	10.13	Ampl.	12.46	15.20	17.54	20.28	22.31	24.5

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29
s s w	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.49	0.53	0.57	1.00
sw by s	0.32	0.38	0.45	0.51	0.58	1.05	1.12	1.19	1.26	1.32	1.37
s w	0.47	0.56	1.06	1.16	1.26	1.36	1.46	1.57	2.08	2.18	2.25
sw by w	1.09	1.23	1.37	1.52	2.06	2.21	2.37	2.53	3.11	3.27	3.39
w s w	1.47	2.07	2.29	2.51	3.14	3.38	4.04	4.33	5.07	5.41	
w by s	3.05	3.39	4.14	4.51	5.32						
West	6.00										
☉ set	6.00	5.58	5.56	5.54	5.51	5.49	5.47	5.45	5.42	5.40	5.39

A Sun-Dial for the Latitude of 13 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	Deg.	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m	Min.		30m			29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.08	0.06	0.04	0.02	0.00	n by w	0.02	0.04	0.06	0.08	0.09
s s w	0.17	0.13	0.09	0.05	0.01	n n w	0.03	0.08	0.12	0.16	0.19
sw by s	0.28	0.21	0.15	0.08	0.01	nw by n	0.06	0.13	0.20	0.26	0.31
s w	0.41	0.31	0.22	0.12	0.02	n w	0.08	0.19	0.30	0.40	0.47
sw by w	1.01	0.47	0.32	0.18	0.03	nwb w	0.13	0.29	0.46	1.01	1.13
w s w	1.33	1.12	0.51	0.28	0.05	w n w	0.21	0.49	1.21	1.52	2.22
w by s	2.41	2.08	1.33	0.34	0.10	w by n	0.48				
West	5.16	4.31	3.41	2.41	1.05						
☉ set	6.02	6.05	6.07	6.09	6.11	☉ set	0.14	6.16	5.19	6.21	6.23
Sun's d m	d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m	d m	d m
Ampl	2.33	5.08	7.42	10.16	12.49	Ampl	15.24	17.59	20.33	22.37	24.11

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.29
s s w	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.55	0.59	1.02
sw by s	0.34	0.41	0.47	0.54	1.00	1.07	1.14	1.21	1.28	1.34	1.39
s w	0.51	1.00	1.10	1.19	1.29	1.39	1.50	2.01	2.12	2.21	2.29
sw by w	1.14	1.28	1.42	1.56	2.11	2.26	2.41	2.58	3.15	3.30	3.42
w s w	1.54	2.15	2.36	2.57	3.20	3.43	4.08	4.37	5.09	5.40	
w by s	3.14	3.47	4.20	4.55	5.34						
West	6.00										
☉ set	6.00	5.58	5.55	5.53	5.51	5.49	5.47	5.44	5.41	5.39	5.37

A Sun-Dial for the Latitude of 14 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	Deg.	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m	Min.		30m			29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07	0.08
s s w	0.19	0.15	0.11	0.07	0.03	n n w	0.02	0.06	0.10	0.14	0.17
sw by s	0.30	0.24	0.17	0.11	0.04	nsw by n	0.03	0.10	0.17	0.23	0.28
s w	0.45	0.35	0.26	0.16	0.06	n w	0.04	0.15	0.26	0.35	0.43
sw by w	1.06	0.52	0.38	0.24	0.09	nsw by w	0.06	0.22	0.40	0.54	1.06
w s w	1.41	1.20	0.59	0.38	0.15	w n w	0.10	0.37	1.03	1.38	2.05
w by s	2.52	2.19	1.46	1.10	0.29	w by n	0.22	1.48			
West	5.19	4.38	3.53	3.00	1.49	West					
☉	6.07	6.05	6.07	6.10	6.12	☉	6.15	6.18	6.21	6.23	6.25
Sun's d m	d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m	d m	d m
Ampl.	2.34	5.09	7.44	10.19	12.53	Ampl.	15.28	18.3	20.38	22.43	24.16

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.50
s s w	0.23	0.27	0.31	0.35	0.39	0.44	0.48	0.52	0.57	1.01	1.03
sw by s	0.37	0.43	0.50	0.56	1.03	1.10	1.16	1.23	1.31	1.36	1.41
s w	0.54	1.04	1.13	1.23	1.33	1.43	1.53	2.04	2.15	2.24	2.31
sw by w	1.20	1.33	1.47	2.01	2.15	2.30	2.45	3.02	3.19	3.33	3.45
w s w	2.01	2.21	2.42	3.03	3.25	3.48	4.12	4.40	5.11	5.40	
w by s	3.22	3.53	4.25	4.59	5.35						
West	5.00										
☉	5.00	5.58	5.55	5.53	5.50	5.48	5.45	5.42	5.39	5.37	5.35

A Sun-Dial for the Latitude of 15 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	Deg.	15 d	17 d	20 d	22 d	23 d
Min.	30m			30m		Min.		30m			29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.10	0.08	0.06	0.04	0.02	n by w		0.02	0.04	0.06	0.07
s s w	0.21	0.16	0.12	0.08	0.04	n n w		0.04	0.09	0.12	0.15
s w by s	0.33	0.26	0.20	0.13	0.07	n w by n		0.07	0.14	0.20	0.25
s w	0.49	0.39	0.30	0.20	0.10	n w		0.11	0.22	0.31	0.38
s w by w	1.11	0.58	0.44	0.30	0.15	n w by w		0.16	0.33	0.47	0.59
w s w	1.48	1.28	1.08	0.47	0.24	w n w		0.26	0.56	1.24	1.50
w by s	3.00	2.30	1.58	1.24	0.46	w by n		1.06			
West	5.22	4.44	4.02	3.15	2.17						
☉ set	6.02	6.05	6.08	6.11	6.13	☉ set	6.16	6.19	6.22	6.25	6.27
Sun's d m	d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m	d m	d m
Ampl.	2.35	5.10	7.46	10.21	12.56	Ampl.	51.32	18.8	20.44	22.49	24.24

Zen. West

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m			30m		30m		30m		29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.31
s s w	0.24	0.28	0.32	0.36	0.40	0.45	0.49	0.53	0.58	1.02	1.04
s w by s	0.39	0.46	0.52	0.59	1.05	1.12	1.18	1.25	1.33	1.39	1.43
s w	0.58	1.07	1.17	1.26	1.36	1.46	1.56	2.07	2.18	2.27	2.34
s w by w	1.25	1.38	1.52	2.06	2.20	2.34	2.49	3.05	3.22	3.37	3.48
w s w	2.08	2.28	2.48	3.08	3.29	3.52	4.16	4.42	5.12	5.40	
w by s	3.30	4.00	4.30	5.02	5.36						
West	6.00										
☉ set	6.00	5.58	5.55	5.52	5.49	5.47	5.44	5.41	5.38	5.35	5.33

A Sun-Dial for the Latitude of 16 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	Deg.	17 d	20 d	22 d	23 d
Min.	30m		30m		30m		Min.	30m			29m
Point	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m
South	12	12	12	12	12	12	North	12	12	12	12
s by w	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.05	0.07
s s w	0.22	0.18	0.14	0.10	0.06	0.02	n n w	0.03	0.07	0.11	0.14
sw by s	0.35	0.29	0.23	0.16	0.10	0.03	nwbw	0.04	0.11	0.17	0.22
s w	0.52	0.43	0.34	0.24	0.14	0.04	n w	0.06	0.17	0.26	0.33
swbw	1.16	1.03	0.49	0.35	0.21	0.06	nwbw	0.10	0.26	0.40	0.52
w s w	1.55	1.36	1.16	0.55	0.33	0.10	w n w	0.16	0.44	1.11	1.34
w by s	3.08	2.39	2.09	1.37	1.02	0.20	w b n	0.36			
West	5.25	4.49	4.11	3.28	2.37	1.23	West				
☉ set	6.03	6.06	6.09	6.12	6.14	6.15	☉ set	6.21	6.21	6.27	6.29
Sun's d	m d	m d	m d	m d	m d	m d	Sun's d	m d	m d	m d	m d
Ampl	2.25	5.12	7.48	10.24	12.0	15.37	Ampl	18.13	20.51	22.56	24.32

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.13	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32
s s w	0.26	0.30	0.34	0.38	0.42	0.46	0.50	0.54	0.59	1.03	1.06
sw by s	0.42	0.48	0.54	1.01	1.07	1.14	1.21	1.28	1.35	1.41	1.45
s w	1.02	1.11	1.20	1.29	1.39	1.49	1.59	2.10	2.21	2.30	2.37
swbw	1.30	1.43	1.56	2.10	2.24	2.38	2.53	3.09	3.25	3.40	3.51
w s w	2.15	2.34	2.54	3.14	3.34	3.56	4.19	4.45	5.13	5.40	
w by s	3.37	4.05	4.34	5.04	5.36						
West	6.00										
☉ set	6.00	5.57	5.54	5.51	5.48	5.45	5.42	5.39	5.36	5.33	5.31

A Sun-Dial for the Latitude of 17 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	Deg.	17 d	20 d	22 d	23 d
Min.	30m		30m		30m		Min.	30m			29m
Point	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m
South	12	12	12	12	12	12	North	12	12	12	12
s by w	0.11	0.09	0.07	0.06	0.04	0.02	n by w	0.00	0.02	0.04	0.06
s s w	0.24	0.20	0.16	0.12	0.08	0.03	n n w	0.01	0.05	0.09	0.12
sw by s	0.38	0.32	0.25	0.19	0.13	0.06	nw by n	0.01	0.08	0.15	0.19
s w	0.56	0.47	0.38	0.28	0.18	0.08	n w	0.02	0.13	0.22	0.29
sw by w	1.21	1.08	0.55	0.41	0.27	0.12	nw by w	0.03	0.19	0.33	0.45
w s w	2.02	1.43	1.23	1.03	0.42	0.19	w n w	0.05	0.33	0.58	1.20
w by s	3.16	2.48	2.20	1.49	1.16	0.37	w by n	0.11	1.36		
West	5.27	4.53	4.18	3.39	2.54	1.55					
w by n					5.50	5.11					
☉ fer	6.03	6.06	6.09	6.12	6.15	6.15	☉ fer	6.22	6.25	6.28	6.31
Sun's	d m	d m	d m	d m	d m	d m	Sun's	d m	d m	d m	d m
Ampl.	2.36	5.13	7.50	10.28	13.04	15.42	Ampl	18.19	20.57	23.4	24.40

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33
s s w	0.28	0.32	0.36	0.39	0.43	0.47	0.52	0.56	1.01	1.04	1.07
sw by s	0.44	0.50	0.57	1.03	1.09	1.16	1.23	1.30	1.37	1.43	1.47
s w	1.05	1.14	1.24	1.33	1.42	1.51	2.02	2.13	2.23	2.32	2.39
sw by w	1.35	1.48	2.01	2.14	2.28	2.42	2.5	3.12	3.29	3.42	3.54
w s w	2.21	2.40	2.59	3.18	3.39	4.00	4.22	4.47	5.14	5.39	
w by s	3.43	4.10	4.38	5.07	5.37						
West	6.00										
☉ fer	6.00	5.57	5.54	5.51	5.48	5.45	5.41	5.38	5.35	5.32	5.29

A Sun-Dial for the Latitude of 18 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	Deg.	20 d	22 d	23 d
Min.	3cm		3cm		3cm		3cm	Min.			29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.12	0.10	0.08	0.06	0.04	0.02	0.00	n by w	0.02	0.03	0.05
s s w	0.25	0.21	0.17	0.13	0.09	0.05	0.01	n n w	0.04	0.07	0.10
sw by s	0.40	0.34	0.28	0.21	0.15	0.09	0.01	n w b n	0.06	0.12	0.16
s w	1.00	0.50	0.41	0.32	0.22	0.12	0.02	n w	0.09	0.17	0.24
sw by w	1.26	1.13	1.00	0.87	0.72	0.58	0.03	n w b w	0.13	0.27	0.38
w s w	2.08	1.50	1.31	1.11	0.91	0.70	0.05	w n w	0.21	0.45	1.06
w by s	3.23	2.57	2.29	2.00	1.29	0.53	0.10	w by n	0.53		
West	5.29	4.57	4.24	3.49	3.08	2.18	0.56				
w by n					5.51	5.15	4.32				
☉ set	6.03	6.06	6.09	6.12	6.16	6.20	6.23	☉ set	6.27	6.30	6.33
Sun's	d m	d m	d m	d m	d m	d m	d m	Sun's	d m	d m	d m
Ampl	2.37	5.15	7.53	10.31	13.9	15.47	18.26	Ampl.	21.4	23.12	24.49

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		3cm		3cm		3cm		3cm			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.33
s s w	0.29	0.33	0.37	0.41	0.45	0.49	0.53	0.58	1.02	1.06	1.08
sw by s	0.47	0.53	0.59	1.05	1.12	1.18	1.25	1.32	1.39	1.45	1.49
s w	1.09	1.18	1.27	1.36	1.46	1.55	2.05	2.15	2.26	2.35	2.42
sw by w	1.39	1.52	2.05	2.18	2.32	2.45	3.00	3.15	3.31	3.45	3.56
w s w	2.27	2.45	3.04	3.23	3.43	4.03	4.25	4.49	5.15	5.39	
w by s	3.49	4.15	4.41	5.09	5.38						
West	6.00										
☉ set	5.00	5.57	5.54	5.51	5.47	5.44	5.40	5.37	5.33	5.30	5.27

A Sun-Dial for the Latitude of 19 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	Deg.	20 d	22 d	23 d
Min.	30m		30m		30m		30m	Min.			29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
12 South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.15	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.01	0.03	0.04
s w	0.27	0.23	0.19	0.15	0.11	0.07	0.03	n n w	0.02	0.05	0.08
s w by s	0.43	0.37	0.30	0.24	0.18	0.11	0.05	n w by n	0.03	0.09	0.13
s w	1.03	0.54	0.45	0.36	0.26	0.17	0.07	n w	0.04	0.13	0.20
s w by w	1.31	1.18	1.05	0.52	0.38	0.24	0.09	n w by w	0.06	0.20	0.31
w s w	2.15	1.57	1.38	1.19	0.59	0.37	0.15	w n w	0.10	0.33	0.53
w by s	3.30	3.04	2.38	2.11	1.41	1.08	0.29	w by n	0.23		
West	5.31	5.01	4.30	3.57	3.20	2.36	1.35				
w by n					5.52	5.19	4.40				
☉ set	6.03	6.07	6.10	6.14	6.17	6.21	6.25	☉ set	6.28	6.31	6.34
Sun's d m	d m	d m	d m	d m	d m	d m	d m	Sun's d m	d m	d m	d m
Amp.	2.38	5.17	7.56	10.35	13.14	15.53	18.33	Ampl.	21.12	23.20	24.48

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12 South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.30	0.32	0.34
s s w	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.59	1.03	1.07	1.09
s w by s	0.49	0.55	1.01	1.08	1.14	1.21	1.27	1.34	1.41	1.47	1.51
s w	1.12	1.21	1.30	1.39	1.48	1.58	2.07	2.18	2.29	2.37	2.44
s w by w	1.44	1.57	2.09	2.23	2.36	2.49	3.04	3.19	3.34	3.48	3.58
w s w	2.33	2.51	3.09	3.27	3.46	4.06	4.28	4.51	5.16	5.39	
w by s	3.54	4.19	4.44	5.10	5.39						
West	6.00										
☉ set	6.00	5.57	5.53	5.50	5.46	5.43	5.39	5.35	5.32	5.29	5.26

A Sun-Dial for the Latitude of 20 Degrees.

North Declination.

Deg. Min.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	Deg. Min.	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.14	0.12	0.10	0.08	0.06	0.04	0.02	n by w		0.02	0.03
s s w	0.28	0.25	0.21	0.17	0.13	0.09	0.05	n n w	Zen. West	0.04	0.06
sw by s	0.45	0.39	0.32	0.26	0.20	0.14	0.07	nw b n		0.06	0.10
s w	1.07	0.58	0.49	0.40	0.30	0.21	0.11	n w		0.09	0.16
sw by w	1.36	1.23	1.10	0.58	0.44	0.30	0.15	nw b w		0.13	0.24
w s w	2.21	2.03	1.45	1.26	1.07	0.46	0.24	w n w		0.22	0.40
w by s	3.36	3.11	2.45	2.20	1.52	1.21	0.45	w by n			
West	5.32	5.04	4.35	4.04	3.30	2.50	2.00	West			
w by n					5.54	5.23	4.47				
☉ set	6.03	6.07	6.11	6.15	6.18	6.22	6.26	☉ set	6.30	6.33	6.36
Sun's Ampl	d 40	d 5	d 7	d 10	d 13	d 16	d 18	Sun's Ampl	d 21	d 23	d 25

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.16	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.34
s s w	0.32	0.36	0.40	0.44	0.48	0.52	0.56	1.00	1.05	1.08	1.11
sw by s	0.51	0.58	1.04	1.10	1.16	1.23	1.29	1.36	1.43	1.49	1.53
s w	1.16	1.24	1.33	1.42	1.51	2.01	2.10	2.20	2.31	2.40	2.47
sw by w	1.48	2.01	2.14	2.26	2.39	2.53	3.07	3.22	3.37	3.50	4.00
w s w	2.38	2.56	3.13	3.31	3.50	4.09	4.30	4.52	5.16	5.38	
w by s	3.59	4.23	4.47	5.12	5.39						
West	5.00										
☉ set	5.00	5.57	5.53	5.49	5.45	5.42	5.38	5.34	5.30	5.27	5.24

A Sun-Dial for the Latitude 21 of Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	Deg.	22 d	23 d
Min.	30m		30m		30m		30m		Min.	29m	
Point	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m
South	12	12	12	12	12	12	12	12	North	12	12
s by w	0.14	0.13	0.11	0.09	0.07	0.05	0.02	0.01	n by w	0.01	0.02
s s w	0.30	0.26	0.22	0.18	0.14	0.10	0.06	0.02	n n w	0.02	0.04
s w by s	0.48	0.42	0.35	0.29	0.23	0.16	0.10	0.03	n w by n	0.03	0.07
s w	1.10	1.01	0.52	0.43	0.34	0.26	0.15	0.04	n w	0.04	0.11
s w by w	1.40	1.28	1.15	1.03	0.49	0.36	0.21	0.06	n w by w	0.06	0.17
w s w	2.26	2.09	1.52	1.34	1.15	0.55	0.33	0.10	w n w	0.11	0.28
w by s	3.41	3.18	2.54	2.29	2.03	1.33	1.00	0.20	w by n	0.24	
West	5.34	5.07	4.40	4.11	3.39	3.03	2.19	1.14			
w by n					5.55	5.26	4.53	4.12			
☉ set	6.04	6.08	6.12	6.16	6.20	6.24	6.28	6.32	☉ set	6.35	6.38
Sun's d	2.41	5.21	8.02	10.43	13.24	16.6	18.47	21.29	Sun's d	23.39	25.18
Ampl.									Ampl.		

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.35
s s w	0.34	0.38	0.42	0.45	0.49	0.54	0.58	1.02	1.06	1.10	1.12
s w by s	0.54	1.00	1.06	1.12	1.19	1.25	1.32	1.38	1.45	1.51	1.55
s w	1.19	1.28	1.37	1.46	1.54	2.04	2.13	2.23	2.33	2.42	2.40
s w by w	1.53	2.05	2.18	2.30	2.43	2.56	3.10	3.24	3.39	3.52	4.02
w s w	2.43	3.01	3.18	3.35	3.54	4.12	4.32	4.53	5.17		
w by s	4.04	4.27	4.50	5.14	5.39						
West	6.00										
☉ set	5.00	5.56	5.52	5.48	5.44	5.40	5.36	5.32	5.28	5.25	5.22

A Sun-Dial for the Latitude of 22 Degrees.

North Declination.

Deg.	4 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	Deg.	22 d	23 d
Min.	30m		30m		30m		30m		Min.	29m	30m
Point	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m
South	12	12	12	12	12	12	12	12	North	12	12
s by w	0.15	0.13	0.11	0.09	0.08	0.06	0.04	0.02	n by w	0.01	0.01
s s w	0.31	0.28	0.24	0.20	0.16	0.12	0.08	0.04	n n w	0.05	0.05
sw by s	0.50	0.44	0.38	0.32	0.25	0.19	0.13	0.06	nw by n	0.04	0.04
s w	1.14	1.05	0.56	0.47	0.38	0.29	0.19	0.08	n w	0.07	0.07
sw by w	1.45	1.33	1.20	1.08	0.55	0.41	0.27	0.13	nw by w	0.10	0.10
w s w	2.32	2.15	1.58	1.40	1.22	1.03	0.42	0.20	w n w	0.17	0.17
w by s	3.46	3.24	3.01	2.38	2.12	1.45	1.14	0.37	w by n		
West	5.35	5.10	4.44	4.17	3.47	3.14	2.35	1.43			
w by n					5.50	5.28	4.58	4.21			
☉ set	6.04	6.08	6.12	6.16	6.21	6.25	6.29	6.34	☉ set	6.37	6.40
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	Sun's d m	d m	d m
Amp.	2.42	5.23	8.05	10.48	13.30	16.13	18.55	21.39	Ampl.	23.50	25.29

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.17	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.35
s s w	0.35	0.39	0.43	0.47	0.50	0.55	0.59	1.03	1.07	1.11	1.13
sw by s	0.56	1.02	1.08	1.14	1.21	1.27	1.33	1.40	1.47	1.52	1.57
s w	1.22	1.31	1.40	1.49	1.58	2.07	2.16	2.25	2.36	2.44	2.51
sw by w	1.57	2.09	2.21	2.34	2.46	2.59	3.13	3.27	3.42	3.54	4.04
w s w	2.49	3.05	3.22	3.39	3.57	4.15	4.34	4.55	5.17		
w by s	4.08	4.30	4.32	5.15	5.39						
West	6.00										
☉ set	6.00	5.56	5.52	5.48	5.44	5.39	5.35	5.31	5.26	5.23	5.20

The Mariner's Compass Rectified.

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A Sun-Dial for the Latitude 23 of Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	Deg.	23 d
Min.	30m		30m		30m		30m			Min.	29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m
South	12	12	12	12	12	12	12	12	12	North	12
s by w	0.16	0.14	0.12	0.11	0.09	0.07	0.05	0.03	0.01	n by w	0.00
s s w	0.33	0.30	0.26	0.22	0.18	0.14	0.10	0.05	0.02	n n w	0.01
s w by s	0.53	0.47	0.41	0.34	0.28	0.22	0.16	0.09	0.03	n w by n	0.01
s w	1.17	1.08	1.00	0.50	0.41	0.32	0.23	0.13	0.04	n w	0.02
s w by w	1.49	1.37	1.25	1.13	1.00	0.47	0.33	0.19	0.06	n w by w	0.03
w s w	2.37	2.21	2.04	1.47	1.29	1.11	0.51	0.29	0.10	w n w	0.06
w by s	3.51	3.30	3.08	2.45	2.21	1.55	1.26	0.54	0.20		
West	5.36	5.12	4.48	4.22	3.54	3.23	2.48	2.04	1.11		
w by n				6.21	5.57	5.31	5.02	4.29	3.56		
w n w											
☉ set	6.04	6.09	6.13	6.17	6.22	6.26	6.31	6.36	6.39	☉ set	6.42
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	Sun's d m	d m
Amp.	2.42	5.26	8.10	10.52	13.36	16.20	19.4	21.49	24.4	Ampl.	25.41

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.36
s s w	0.37	0.41	0.44	0.48	0.51	0.56	1.00	1.04	1.08	1.12	1.15
s w by s	0.59	1.04	1.10	1.16	1.23	1.29	1.35	1.42	1.49	1.54	1.59
s w	1.25	1.34	1.43	1.51	2.01	2.10	2.19	2.28	2.38	2.46	2.53
s w by w	2.01	2.13	2.25	2.37	2.50	3.02	3.16	3.29	3.44	3.56	4.06
w s w	2.53	3.10	3.26	3.43	4.00	4.17	4.36	4.56	5.17		
w by s	4.12	4.33	4.54	5.16	5.39						
West	6.00										
☉ set	6.00	5.56	5.51	5.47	5.43	5.38	5.34	5.29	5.24	5.21	5.18

A Sun-Dial for the Latitude of 24 Degrees.

North Declination.

Deg.	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12
s by w	0.17	0.15	0.13	0.11	0.09	0.08	0.06	0.04	0.02	0.00
s s w	0.35	0.31	0.27	0.23	0.19	0.15	0.11	0.07	0.04	0.01
sw by s	0.55	0.49	0.43	0.37	0.30	0.24	0.18	0.11	0.06	0.01
s w	1.20	1.12	1.03	0.53	0.44	0.35	0.27	0.17	0.09	0.02
sw by w	1.54	1.42	1.30	1.18	1.05	0.52	0.39	0.24	0.13	0.03
w s w	2.42	2.26	2.10	1.53	1.36	1.18	0.59	0.38	0.20	0.05
w by s	3.50	3.35	3.14	2.52	2.29	2.05	1.38	1.07	0.38	0.10
West	5.37	5.15	4.51	4.27	4.01	3.32	3.00	2.21	1.39	0.50
w by n				6.21	5.58	5.33	5.06	4.35	4.06	3.09
n n w									6.24	6.09
☉ set	6.04	6.09	6.13	6.18	6.23	6.27	6.32	6.37	6.41	6.44
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	2.44	5.28	8.13	10.57	13.42	16.27	19.13	21.59	24.12	25.54

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.37
s s w	0.38	0.42	0.46	0.50	0.53	0.57	1.01	1.05	1.10	1.13	1.16
sw by s	1.01	1.07	1.13	1.19	1.25	1.31	1.37	1.44	1.50	1.56	2.00
s w	1.29	1.37	1.46	1.54	2.04	2.13	2.21	2.31	2.40	2.48	2.55
sw by w	2.05	2.17	2.29	2.41	2.53	3.05	3.18	3.32	3.46	3.58	4.00
w s w	2.58	3.14	3.30	3.46	4.02	4.20	4.38	4.57	5.18		
w by s	4.16	4.36	4.56	5.17	5.39						
West	6.00										
☉ set	6.00	5.56	5.51	5.47	5.42	5.37	5.33	5.28	5.23	5.19	5.16

A Sun-Dial for the Latitude of 25 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.19	0.17	0.16	0.14	0.12	0.10	0.08	0.06	0.04	0.02	0.01
s w	0.40	0.36	0.32	0.29	0.25	0.21	0.17	0.13	0.09	0.05	0.03
sw by s	1.03	0.57	0.51	0.45	0.39	0.33	0.27	0.21	0.14	0.09	0.04
s w	1.32	1.23	1.15	1.06	0.57	0.47	0.40	0.31	0.21	0.13	0.06
sw by w	2.09	2.58	1.46	1.35	1.22	1.10	0.58	0.44	0.31	0.19	0.10
w s w	3.02	2.47	2.32	2.16	2.00	1.43	1.25	1.07	0.47	0.29	0.15
w by s	4.19	4.00	3.40	3.20	2.59	2.37	2.14	1.48	1.19	0.53	0.29
West	6.00	5.38	5.17	4.54	4.31	4.06	3.40	3.10	2.35	2.00	1.24
w by n					6.21	5.59	5.36	5.10	4.41	4.14	3.50
w n w										6.25	6.10
☉ set	6.00	6.05	6.09	6.14	6.19	6.24	6.29	6.34	6.39	6.43	6.47
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Ampl	0.00	2.45	5.31	8.16	11.3	13.49	16.35	19.22	22.10	24.24	26.8

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.38
s w	0.40	0.43	0.47	0.51	0.55	0.59	1.02	1.06	1.11	1.14	1.17
sw by s	1.03	1.09	1.15	1.21	1.27	1.33	1.39	1.46	1.52	1.58	2.02
s w	1.32	1.40	1.48	1.57	2.06	2.15	2.23	2.33	2.42	2.50	2.57
sw by w	2.09	2.21	2.32	2.44	2.56	3.08	3.21	3.34	3.48	4.00	4.09
w s w	3.02	3.18	3.33	3.49	4.05	4.22	4.39	4.58	5.19		
w by s	4.19	4.39	4.58	5.18	5.39						
West	6.00										
☉ set	6.00	5.55	5.51	5.46	5.41	5.36	5.31	5.26	5.21	5.17	5.13

A Sun-Dial for the Latitude of 26 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.03	0.02
s s w	0.41	0.38	0.34	0.30	0.26	0.23	0.19	0.15	0.11	0.07	0.04
sw by s	1.05	0.59	0.54	0.48	0.42	0.36	0.30	0.24	0.17	0.11	0.07
s w	1.35	1.26	1.18	1.10	1.01	0.51	0.43	0.34	0.25	0.17	0.11
sw by w	2.13	2.02	1.50	1.39	1.27	1.15	1.03	0.50	0.36	0.25	0.16
w s w	3.07	2.52	2.37	2.21	2.06	1.49	1.32	1.14	0.55	0.38	0.25
w by s	4.22	4.04	3.45	3.25	3.06	2.46	2.23	1.58	1.31	1.0	0.45
West	6.00	5.39	5.19	4.57	4.35	4.12	3.47	3.19	2.47	2.16	1.47
w by n					6.21	6.00	5.38	5.13	4.46	4.22	4.00
w n w									6.42	6.25	6.12
☉ set	6.00	6.05	6.10	6.15	6.20	6.25	6.30	6.35	6.41	6.45	6.49
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Ampl	0.00	2.46	5.33	8.21	11.8	13.56	16.44	19.33	22.22	24.37	26.23

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.20	0.22	0.24	0.25	0.27	0.29	0.31	0.33	0.35	0.36	0.38
s s w	0.41	0.45	0.49	0.52	0.56	1.00	1.04	1.08	1.12	1.15	1.18
sw by s	1.05	1.11	1.17	1.23	1.29	1.35	1.41	1.47	1.54	1.59	2.03
s w	1.35	1.43	1.51	2.00	2.08	2.17	2.26	2.35	2.44	2.52	2.59
sw by w	2.13	2.24	2.36	2.47	2.59	3.11	3.23	3.36	3.50	4.01	4.10
w s w	3.07	3.21	3.37	3.52	4.08	4.24	4.41	4.59	5.18		
w by s	4.22	4.41	5.00	5.19	5.39						
West.	6.00										
☉ set	6.00	5.55	5.50	5.45	5.40	5.35	5.30	5.25	5.19	5.15	5.11

A Sun-Dial for the Latitude of 27 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.21	0.19	0.17	0.15	0.13	0.12	0.10	0.08	0.06	0.04	0.03
s w	0.43	0.39	0.35	0.32	0.28	0.24	0.20	0.17	0.12	0.09	0.00
w by s	1.07	1.02	0.56	0.50	0.45	0.39	0.33	0.27	0.20	0.13	0.10
s w	1.38	1.30	1.21	1.13	1.05	0.55	0.47	0.38	0.29	0.21	0.15
w by w	2.17	2.06	1.55	1.43	1.32	1.20	1.08	0.55	0.42	0.32	0.23
w s w	3.10	2.56	2.41	2.20	2.11	1.55	1.39	1.22	1.03	0.47	0.34
w by s	4.25	4.07	3.49	3.31	3.11	2.53	2.31	2.07	1.42	1.19	0.59
West	6.00	5.40	5.21	5.00	4.39	4.17	3.53	3.27	2.58	2.30	2.05
w by n					6.21	5.01	5.39	5.17	4.51	4.28	4.09
w n w									6.42	6.26	6.13
☉ set	5.00	6.05	5.10	6.15	6.21	6.26	6.31	6.37	6.43	6.48	6.51
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp	0.00	2.48	5.37	8.25	11.14	14.3	16.53	19.43	22.34	24.51	26.37

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.21	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.37	0.38
s s w	0.43	0.46	0.50	0.53	0.57	1.01	1.05	1.09	1.13	1.16	1.19
w by s	1.07	1.13	1.19	1.25	1.30	1.36	1.42	1.48	1.55	2.01	2.05
s w	1.38	1.46	1.54	2.02	2.11	2.19	2.28	2.37	2.46	2.54	3.00
w by w	2.17	2.28	2.39	2.50	3.02	3.13	3.26	3.38	3.52	4.02	4.10
w s w	3.10	3.25	3.40	3.54	4.10	4.25	4.42	4.59	5.13		
w by s	4.25	4.43	5.02	5.20	5.39						
West	6.00										
☉ set	6.00	5.55	5.50	5.45	5.39	5.34	5.29	5.23	5.17	5.12	5.00

A Sun-Dial for the Latitude of 28 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.04
s s w	0.44	0.40	0.37	0.33	0.30	0.26	0.22	0.18	0.14	0.11	0.08
sw by s	1.10	1.04	0.58	0.53	0.47	0.41	0.35	0.29	0.22	0.16	0.13
s w	1.41	1.33	1.25	1.17	1.08	1.00	0.51	0.42	0.33	0.25	0.19
sw by w	2.20	2.10	1.59	1.48	1.36	1.25	1.13	1.01	0.48	0.37	0.28
w s w	3.14	3.00	2.46	2.31	2.17	2.01	1.45	1.28	1.11	0.55	0.43
w by s	4.28	4.11	2.53	3.36	3.17	3.00	2.38	2.16	1.52	1.31	1.13
West	6.00	5.41	5.22	5.03	4.43	4.21	3.59	3.35	3.07	2.42	2.20
w by n					6.21	6.02	5.41	5.20	4.56	4.34	4.16
w n w									6.42	6.27	6.14
☉ set	6.00	6.05	6.11	6.16	6.22	6.27	6.33	6.39	6.45	6.50	6.53
Sun's d	md	md	md	md	md	md	md	md	md	md	md
Ampl	0.00	2.50	5.40	8.20	11.21	14.11	17.3	19.54	22.48	25.6	26.52

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.36	0.36	0.38	0.39
s s w	0.44	0.48	0.51	0.55	0.58	1.02	1.06	1.14	1.14	1.17	1.20
sw by s	1.10	1.15	1.21	1.27	1.32	1.38	1.44	1.57	1.57	2.03	2.06
s w	1.41	1.49	1.57	2.05	2.13	2.21	2.30	2.47	2.47	2.56	3.02
sw by w	2.20	2.31	2.42	2.53	3.04	3.16	3.28	3.40	3.53	4.04	4.13
w s w	3.14	3.28	3.43	3.57	4.12	4.27	4.44	5.00	5.18		
w by s	4.28	4.45	5.03	5.21	5.39						
West.	6.00										
☉ set	6.00	5.55	5.49	5.44	5.38	5.33	5.27	5.21	5.15	5.10	5.07

A Sun-Dial for the Latitude of 29 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m		30m		30m		29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0.20	0.19	0.17	0.15	0.13	0.11	0.10	0.08	0.06	0.05
s s w	0.45	0.42	0.38	0.35	0.31	0.27	0.23	0.19	0.16	0.12	0.10
s w by s	1.12	1.06	1.01	0.55	0.49	0.43	0.37	0.31	0.25	0.20	0.16
s w	1.43	1.36	1.28	1.20	1.12	1.03	0.55	0.46	0.37	0.29	0.23
s w by w	2.23	2.13	2.03	1.52	1.41	1.30	1.18	1.05	0.53	0.42	0.34
w s w	3.18	3.04	2.50	2.36	2.22	2.07	1.52	1.35	1.18	1.03	0.51
w by s	4.31	4.14	3.57	3.40	3.22	3.05	2.45	2.24	2.01	1.41	1.24
West	5.00	5.42	5.24	5.05	4.46	4.26	4.04	3.41	3.16	2.53	2.33
w by n					6.21	6.02	5.43	5.22	5.00	4.40	4.23
w n w									6.42	6.27	6.15
☉ set	6.00	6.06	6.11	6.17	6.23	6.28	6.34	6.40	6.47	6.52	6.58
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl	0.00	2.51	5.43	8.34	11.27	14.19	17.12	20.6	23.2	25.22	27.8

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m			30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0.24	0.26	0.27	0.29	0.31	0.33	0.35	0.37	0.38	0.39
s s w	0.45	0.49	0.53	0.56	1.00	1.04	1.08	1.11	1.15	1.18	1.21
s w by s	1.12	1.17	1.23	1.29	1.34	1.40	1.46	1.52	1.59	2.04	2.08
s w	1.43	1.51	1.59	2.07	2.15	2.24	2.32	2.41	2.49	2.58	3.04
s w by w	2.23	2.34	2.45	2.56	3.07	3.18	3.30	3.42	3.55	4.05	4.14
w s w	3.18	3.32	3.46	4.00	4.14	4.29	4.44	5.00			
w by s	4.31	4.48	5.04	5.22	5.39						
West	6.00										
☉ set	6.00	5.54	5.49	5.43	5.37	5.32	5.26	5.20	5.13	5.08	5.02

A Sun-Dial for the Latitude of 30 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.21	0.19	0.18	0.16	0.14	0.12	0.10	0.08	0.07	0.06
s s w	0.47	0.43	0.40	0.36	0.33	0.29	0.25	0.21	0.17	0.14	0.12
sw by s	1.14	1.08	1.03	0.98	0.92	0.86	0.80	0.74	0.68	0.63	0.59
s w	1.46	1.38	1.31	1.23	1.15	1.07	0.98	0.90	0.81	0.73	0.67
sw by w	2.27	2.17	2.06	1.96	1.85	1.74	1.63	1.51	1.40	1.29	1.18
w s w	3.21	3.08	2.55	2.41	2.27	2.13	1.98	1.84	1.69	1.55	1.41
w by s	4.33	4.17	4.01	3.84	3.67	3.50	3.32	3.14	2.96	2.78	2.60
West	6.00	5.43	5.25	5.07	4.49	4.30	4.09	3.48	3.24	3.02	2.44
w by n					6.21	6.03	5.45	5.25	5.03	4.45	4.29
w n w									6.42	6.28	6.17
☉ fer	6.00	6.06	6.12	6.18	6.23	6.29	6.36	6.42	6.48	6.54	6.58
Sun s	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0 00	2 53	5.46	8.40	11.34	14.28	17.23	20.18	23.16	25.38	27.25

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0.24	0.26	0.28	0.30	0.31	0.33	0.35	0.37	0.39	0.40
s s w	0.47	0.50	0.54	0.57	1.01	1.05	1.09	1.12	1.16	1.19	1.22
sw by s	1.14	1.19	1.25	1.30	1.36	1.42	1.48	1.54	2.00	2.05	2.09
s w	1.46	1.54	2.02	2.10	2.18	2.26	2.34	2.43	2.50	2.59	3.05
sw by w	2.27	2.38	2.48	2.58	3.09	3.20	3.32	3.44	3.56	4.06	4.14
w s w	3.21	3.35	3.48	4.02	4.16	4.30	4.45	5.01			
w by s	4.33	4.49	5.05	5.22	5.39						
West	6.00										
☉ fer	5.00	5.54	5.48	5.42	5.37	5.31	5.24	5.18	5.12	5.06	5.02

A Sun-Dial for the Latitude of 31 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.22	0.20	0.18	0.17	0.15	0.13	0.11	0.09	0.08	0.07
s s w	0.48	0.45	0.41	0.38	0.34	0.31	0.27	0.23	0.19	0.16	0.13
sw by s	1.16	1.11	1.05	1.00	0.54	0.48	0.43	0.37	0.31	0.25	0.21
s w	1.49	1.41	1.34	1.26	1.18	1.10	1.02	0.53	0.45	0.37	0.32
sw by w	2.30	2.20	2.10	2.00	1.49	1.38	1.27	1.16	1.04	0.54	0.46
w s w	3.25	3.12	2.59	2.45	2.32	2.18	2.03	1.48	1.32	1.18	1.07
w by s	4.36	4.20	4.04	3.48	3.32	3.15	2.57	2.38	2.18	2.00	1.46
West	5.00	5.43	5.26	5.09	4.52	4.33	4.14	3.53	3.31	3.11	2.55
w by n					6.21	6.04	5.46	5.27	5.07	4.49	4.35
w n w									6.43	6.29	6.18
☉ set	6.00	6.06	6.12	6.18	6.24	6.31	6.37	6.44	6.51	6.56	7.01
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Ampl	0.00	2.55	5.50	8.46	11.41	14.37	17.34	20.31	23.31	25.55	27.43

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.38	0.39	0.40
s s w	0.48	0.52	0.55	0.59	1.02	1.06	1.10	1.13	1.17	1.20	1.23
sw by s	1.16	1.21	1.27	1.32	1.38	1.44	1.49	1.55	2.01	2.07	2.11
s w	1.49	1.57	2.04	2.12	2.20	2.28	2.36	2.45	2.52	3.01	3.06
sw by w	2.30	2.41	2.51	3.01	3.12	3.23	3.34	3.45	3.57	4.07	4.15
w s w	3.25	3.38	3.51	4.04	4.18	4.32	4.46	5.01			
w by s	4.36	4.50	5.07	5.23							
West	6.00										
☉ set	6.00	5.54	5.48	5.42	5.36	5.29	5.23	5.16	5.09	5.04	4.59

A Sun-Dial for the Latitude of 32 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.24	0.22	0.21	0.19	0.17	0.16	0.14	0.12	0.10	0.09	0.07
s s w	0.50	0.46	0.43	0.39	0.36	0.32	0.29	0.25	0.21	0.18	0.15
sw by s	1.18	1.13	1.07	1.02	0.96	0.91	0.85	0.79	0.73	0.68	0.62
s w	1.52	1.44	1.37	1.29	1.22	1.14	1.05	0.97	0.89	0.81	0.73
sw by w	2.34	2.24	2.14	2.04	1.94	1.83	1.72	1.61	1.50	1.39	1.28
w s w	3.28	3.15	3.03	2.50	2.37	2.23	2.09	1.94	1.79	1.65	1.50
w by s	4.28	4.23	4.08	3.52	3.37	3.20	3.03	2.85	2.66	2.49	2.31
West	6.00	5.44	5.28	5.11	4.55	4.37	4.19	3.99	3.78	3.57	3.34
w by n					6.21	6.05	5.48	5.30	5.10	4.53	4.39
w n w									6.43	6.30	6.19
☉ set	6.00	6.06	6.13	6.19	6.25	6.32	6.39	6.46	6.53	6.58	7.03
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0.00	2.57	5.54	8.51	11.48	14.47	17.46	20.45	23.47	26.13	28.3

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.24	0.26	0.27	0.29	0.31	0.32	0.34	0.36	0.38	0.40	0.41
s s w	0.50	0.53	0.56	1.00	1.03	1.07	1.11	1.14	1.18	1.21	1.24
sw by s	1.18	1.23	1.29	1.34	1.40	1.45	1.50	1.57	2.03	2.08	2.12
s w	1.52	1.59	2.07	2.14	2.22	2.30	2.38	2.47	2.53	3.02	3.08
sw by w	2.34	2.44	2.54	3.04	3.14	3.25	3.35	3.47	3.59	4.08	4.16
w s w	3.28	3.41	3.53	4.06	4.19	4.33	4.47	5.02			
w by s	4.38	4.53	5.18	5.23							
West	5.00										
☉ set	6.00	5.54	5.47	5.41	5.35	5.28	5.21	5.14	5.07	5.02	4.57

A Sun-Dial for the Latitude of 33 Degrees.

North Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.23	0.21	0.20	0.18	0.16	0.15	0.13	0.11	0.09	0.08
s s w	0.51	0.47	0.44	0.41	0.37	0.34	0.30	0.27	0.23	0.19	0.17
s w by s	1.20	1.15	1.09	1.04	0.59	0.53	0.48	0.42	0.36	0.31	0.27
s w	1.54	1.47	1.40	1.32	1.25	1.17	1.09	1.01	0.53	0.46	0.40
s w by w	2.37	2.27	2.17	2.07	1.57	1.47	1.36	1.25	1.14	1.04	0.57
w s w	3.31	3.19	3.06	2.54	2.41	2.28	2.14	2.00	1.45	1.32	1.22
w by s	4.40	4.25	4.11	3.56	3.41	3.25	3.09	2.51	2.33	2.17	2.04
West	6.00	5.45	5.29	5.13	4.57	4.40	4.23	4.04	3.44	3.26	3.12
w by n					6.21	6.05	5.49	5.32	5.13	4.57	4.44
w n w									6.43	6.30	6.20
☉ set	6.00	6.07	6.13	6.20	6.26	6.33	6.40	6.47	6.55	7.01	7.06
Sun's Amp.	0.00	2.59	5.58	8.57	11.55	14.57	17.58	21.0	24.4	26.32	28.23

South Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.26	0.28	0.30	0.31	0.33	0.35	0.37	0.39	0.40	0.41
s s w	0.51	0.54	0.58	1.01	1.05	1.08	1.12	1.15	1.19	1.22	1.25
s w by s	1.20	1.25	1.30	1.36	1.41	1.47	1.52	1.58	2.04	2.09	2.13
s w	1.54	2.02	2.09	2.17	2.24	2.32	2.40	2.48	2.55	3.04	3.10
s w by w	2.37	2.46	2.56	3.06	3.16	3.27	3.37	3.48	4.00	4.09	4.17
w s w	3.31	3.43	3.56	4.08	4.21	4.34	4.48	5.02			
w by s	4.40	4.54	5.09	5.24							
West	6.00										
☉ set	6.00	5.53	5.47	5.40	5.34	5.27	5.20		5.05	4.59	4.54

A Sun-Dial for the Latitude of 34 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.24	0.22	0.20	0.19	0.17	0.15	0.14	0.12	0.10	0.08
s s w	0.52	0.49	0.45	0.42	0.39	0.35	0.32	0.28	0.24	0.21	0.18
sw by s	1.22	1.17	1.12	1.07	1.01	0.56	0.50	0.44	0.38	0.34	0.30
s w	1.57	1.50	1.42	1.35	1.28	1.20	1.12	1.04	0.56	0.49	0.44
sw by w	2.40	2.30	2.21	2.11	2.01	1.51	1.41	1.30	1.19	1.09	1.00
w s w	3.34	3.22	3.10	2.58	2.45	2.33	2.19	2.06	1.51	1.39	1.27
w by s	4.42	4.28	4.14	3.59	3.45	3.30	3.14	2.57	2.40	2.24	2.10
West	5.00	5.45	5.30	5.15	5.00	4.43	4.26	4.09	3.49	3.33	3.18
w by n					6.21	6.06	5.50	5.34	5.16	5.01	4.48
w n w									5.43	6.31	6.20
☉ set	6.00	6.07	6.14	6.20	6.27	6.34	6.42	6.49	6.57	7.03	7.08
Sun's	d	md	md	md	md	md	md	md	md	md	md
Ampl.	0.00	3.01	6.02	9.03	12.03	15.08	17.11	21.16	24.22	26.52	28.45

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.27	0.29	0.30	0.32	0.34	0.35	0.37	0.39	0.41	0.42
s s w	0.52	0.55	0.59	1.02	1.06	1.09	1.13	1.16	1.20	1.23	1.26
sw by s	1.22	1.27	1.32	1.38	1.43	1.48	1.54	2.00	2.05	2.10	2.14
s w	1.57	2.04	2.11	2.19	2.26	2.34	2.42	2.50	2.57	3.05	3.10
sw by w	2.40	2.49	2.59	3.09	3.18	3.28	3.39	3.50	4.01	4.10	4.18
w s w	3.34	3.46	3.58	4.10	4.22	4.35	4.48	5.02			
w by s	4.42	4.56	5.10	5.24							
West	5.00										
☉ set	5.00	5.53	5.46	5.40	5.33	5.26	5.18	5.11	5.03	4.57	4.52

A Sun-Dial for the Latitude of 35 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.26	0.24	0.23	0.21	0.19	0.18	0.16	0.14	0.13	0.11	0.10
s s w	0.53	1.50	0.47	0.44	0.40	0.37	0.33	0.30	0.26	0.23	0.20
sw by s	1.24	1.19	1.14	1.09	1.03	0.58	0.52	0.47	0.41	0.36	0.32
s w	1.59	1.52	1.45	1.38	1.31	1.23	1.15	1.08	0.59	0.53	0.47
sw by w	2.43	2.33	2.24	2.14	2.05	1.55	1.45	1.34	1.23	1.14	1.07
w s w	3.37	3.35	3.13	3.02	2.50	2.37	2.24	2.11	1.57	1.45	1.36
w by s	4.43	4.30	4.16	4.03	3.48	3.34	3.19	3.03	2.46	2.31	2.20
West	6.00	5.46	5.31	5.17	5.02	4.46	4.30	4.13	3.55	3.39	3.26
w by n					6.21	6.07	5.52	5.36	5.19	5.04	4.53
w n w									6.44	6.32	6.22
☉ set	6.00	6.07	6.14	6.21	6.28	6.35	6.43	6.51	6.59	7.06	7.11
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Amp.	0.00	30.3	6.06	9.10	12.12	15.19	18.25	21.32	24.41	27.13	29.5

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.26	0.28	0.29	0.31	0.33	0.34	0.35	0.38	0.40	0.41	0.42
s s w	0.53	0.57	1.00	1.04	1.07	1.10	1.14	1.17	1.21	1.24	1.27
sw by s	1.24	1.29	1.34	1.39	1.45	1.50	1.55	2.01	2.07	2.12	2.15
s w	1.59	2.06	2.14	2.21	2.28	2.36	2.43	2.51	2.59	3.06	3.11
sw by w	2.43	2.52	3.01	3.11	3.20	3.30	3.40	3.51	4.02	4.11	4.18
w s w	3.37	3.48	4.00	4.12	4.24	4.36	4.49	5.02			
w by s	4.43	4.57	5.11	5.24							
West	6.00										
☉ set	6.00	5.53	5.46	5.39	5.32	5.25	5.17	5.09	5.09	4.54	4.49

A Sun-Dial for the Latitude of 36 Degrees.

North Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.25	0.23	0.22	0.20	0.19	0.17	0.15	0.13	0.12	0.11
s s w	0.55	0.51	0.48	0.45	0.42	0.38	0.35	0.31	0.28	0.24	0.22
s w by s	1.26	1.21	1.16	1.11	1.05	1.00	0.55	0.49	0.44	0.39	0.35
s w	2.02	1.55	1.48	1.41	1.34	1.26	1.19	1.11	1.03	0.56	0.51
s w by w	2.45	2.36	2.27	2.18	2.08	1.59	1.49	1.39	1.28	1.19	1.12
w s w	3.39	3.28	3.17	3.05	2.53	2.41	2.29	2.16	2.03	1.51	1.42
w by s	4.45	4.32	4.19	4.06	3.52	3.38	3.23	3.08	2.52	2.38	2.27
West	6.00	5.46	5.32	5.18	5.04	4.49	4.33	4.17	4.00	3.45	3.33
w by n					6.22	6.08	5.53	5.38	5.22	5.08	4.57
w n w									6.44	6.33	6.24
☉ set	6.00	6.07	6.15	6.22	6.29	6.37	6.45	6.53	7.01	7.08	7.14
Sun's Ampl	0.00	3.16	6.11	9.17	12.24	15.31	18.40	21.49	25.0	27.35	29.32

South Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.28	0.30	0.31	0.33	0.35	0.36	0.38	0.40	0.41	0.43
s s w	0.55	0.58	1.01	1.05	1.08	1.11	1.15	1.18	1.22	1.25	1.27
s w by s	1.26	1.31	1.36	1.41	1.46	1.51	1.57	2.02	2.08	2.13	2.16
s w	2.02	2.09	2.16	2.23	2.30	2.37	2.45	2.53	3.01	3.07	3.12
s w by w	2.45	2.54	3.04	3.13	3.22	3.32	3.42	3.52	4.03	4.12	4.18
w s w	3.39	3.51	4.02	4.13	4.25	4.37	4.49	5.02			
w by s	4.45	4.58	5.11	5.25							
West	6.00										
☉ set	6.00	5.53	5.45	5.38	5.31	5.23	5.15	5.07	4.59	4.52	4.46

A Sun-Dial for the Latitude 37 of Degrees.

North Declination.

Deg.	0 d	5 d	10 d	15 d	20 d	25 d	30 d	35 d	40 d	45 d	50 d	55 d	60 d
Min.	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12	12	12
by w	0.27	0.26	0.24	0.23	0.21	0.19	0.18	0.16	0.14	0.13	0.12	0.12	0.12
s w	0.56	0.53	0.50	0.46	0.43	0.40	0.36	0.33	0.29	0.26	0.24	0.24	0.24
by s	1.28	1.23	1.18	1.13	1.08	1.02	0.97	0.92	0.87	0.81	0.76	0.71	0.66
s w	2.04	1.57	1.50	1.43	1.36	1.29	1.22	1.14	1.07	1.00	0.95	0.89	0.83
by w	2.48	2.39	2.30	2.21	2.12	2.03	1.93	1.83	1.73	1.63	1.53	1.43	1.33
s w	3.42	3.31	3.20	3.09	2.97	2.86	2.74	2.62	2.50	2.38	2.26	2.14	2.02
by s	4.47	4.34	4.21	4.09	3.96	3.83	3.70	3.57	3.44	3.31	3.18	3.05	2.92
West	6.00	5.47	5.33	5.19	5.06	4.52	4.37	4.21	4.05	3.50	3.39	3.28	3.17
by n					6.22	6.08	5.54	5.40	5.24	5.11	5.00	4.89	4.78
n w									6.44	6.33	6.25	6.17	6.09
☉ set	6.00	6.08	6.15	6.23	6.31	6.39	6.47	6.55	7.04	7.11	7.17	7.23	7.29
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	3.08	6.16	9.25	12.32	15.44	18.55	22.8	25.21	27.58	29.58	31.17	32.36

South Declination.

Deg.	0 d	5 d	10 d	15 d	20 d	25 d	30 d	35 d	40 d	45 d	50 d	55 d	60 d
Min.	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m	30m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12	12	12
by w	0.27	0.29	0.31	0.32	0.34	0.35	0.37	0.39	0.41	0.42	0.43	0.43	0.43
s w	0.56	0.59	1.02	1.06	1.09	1.12	1.16	1.19	1.23	1.26	1.28	1.28	1.28
by s	1.28	1.33	1.37	1.42	1.47	1.53	1.58	2.04	2.09	2.14	2.17	2.17	2.17
s w	2.04	2.11	2.18	2.25	2.32	2.39	2.46	2.54	3.02	3.08	3.13	3.13	3.13
by w	2.48	2.57	3.06	3.15	3.24	3.33	3.43	3.53	4.03	4.12	4.19	4.19	4.19
s w	3.42	3.53	4.04	4.15	4.26	4.38	4.50	5.02					
by s	4.47	5.00	5.12	5.25									
West	6.00												
☉ set	6.00	5.52	5.45	5.37	5.29	5.21	5.13	5.05	4.56	4.49	4.43	4.37	4.31

A Sun-Dial for the Latitude of 38 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.28	0.26	0.25	0.23	0.21	0.20	0.18	0.17	0.15	0.13	0.12
s s w	0.57	0.54	0.51	0.48	0.45	0.41	0.38	0.34	0.31	0.28	0.26
sw by s	1.29	1.24	1.20	1.15	1.10	1.05	1.00	0.54	0.49	0.44	0.41
s w	2.06	2.00	1.53	1.46	1.39	1.32	1.25	1.18	1.10	1.04	0.59
sw by w	2.51	2.42	2.33	2.24	2.15	2.06	1.57	1.47	1.37	1.29	1.22
w s w	3.44	3.34	3.23	3.12	3.01	2.50	2.39	2.26	2.13	2.03	1.54
w by s	4.48	4.36	4.24	4.12	4.00	3.46	3.33	3.18	3.03	2.50	2.40
West	6.00	5.47	5.34	5.21	5.08	4.54	4.41	4.25	4.09	3.55	3.45
w by n					6.22	6.09	5.56	5.41	5.26	5.14	5.04
w n w									5.45	6.34	6.26
(.) set	6.00	6.00	6.16	6.24	6.32	6.40	6.48	6.57	7.06	7.14	7.19
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Amp.	0.00	3.10	6.21	9.32	12.43	15.56	19.11	22.26	25.43	28.23	30.24

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.28	0.30	0.31	0.33	0.34	0.36	0.38	0.39	0.41	0.42	0.44
s s w	0.57	1.00	1.04	1.07	1.10	1.13	1.16	1.20	1.24	1.27	1.29
sw by s	1.29	1.34	1.39	1.44	1.49	1.54	1.59	2.05	2.10	2.15	2.18
s w	2.06	2.13	2.20	2.27	2.34	2.41	2.48	2.55	3.03	3.09	3.14
sw by w	2.51	2.59	3.08	3.17	3.26	3.35	3.44	3.54	4.04	4.13	4.19
w s w	3.44	3.55	4.06	4.17	4.28	4.39	4.50	5.02			
w by s	4.48	5.00	5.13	5.25							
West	6.00										
(.) set	6.00	5.52	5.44	5.36	5.28	5.20	5.12	5.03	4.54	4.46	4.41

A Sun-Dial for the Latitude 39 of Degrees.

North Declination.

Deg. Min.	0 d	2 d	4 d	6 d	8 d	10 d	12 d	14 d	16 d	18 d	20 d	22 d	24 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12	12	12
by w	0.29	0.27	0.24	0.24	0.22	0.21	0.19	0.17	0.16	0.14	0.13	0.13	0.13
sw	0.58	0.55	0.52	0.49	0.46	0.43	0.39	0.36	0.32	0.30	0.27	0.27	0.27
sw by s	1.31	1.26	1.22	1.17	1.12	1.07	1.02	0.57	0.51	0.47	0.43	0.43	0.43
sw	2.09	2.02	1.55	1.49	1.42	1.35	1.28	1.21	1.13	1.07	1.02	1.02	1.02
sw by w	2.53	2.45	2.36	2.27	2.19	2.10	2.01	1.51	1.41	1.33	1.27	1.27	1.27
sw	3.47	3.36	3.26	3.15	3.05	2.54	2.42	2.31	2.18	2.08	2.00	2.00	2.00
sw by s	4.50	4.38	4.26	4.14	4.02	3.49	3.36	3.23	3.08	2.56	2.47	2.47	2.47
West	6.00	5.48	5.35	5.22	5.10	4.56	4.43	4.28	4.13	4.00	3.50	3.50	3.50
sw by n					6.22	6.10	5.57	5.43	5.29	5.16	5.07	5.07	5.07
n w									6.45	6.35	6.27	6.27	6.27
☉ set	6.00	6.08	6.16	6.24	6.32	6.41	6.50	6.59	7.09	7.16	7.22	7.22	7.22
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	3.13	6.26	9.40	12.54	16.10	19.28	22.45	26.06	28.49	30.52	30.52	30.52

South Declination.

Deg. Min.	0 d	2 d	4 d	6 d	8 d	10 d	12 d	14 d	16 d	18 d	20 d	22 d	24 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12	12	12
by w	0.29	0.30	0.32	0.33	0.35	0.36	0.38	0.40	0.41	0.43	0.44	0.44	0.44
sw	0.58	1.02	1.05	1.08	1.11	1.14	1.18	1.21	1.25	1.27	1.30	1.30	1.30
sw by s	1.31	1.36	1.41	1.46	1.51	1.56	2.01	2.06	2.11	2.16	2.19	2.19	2.19
sw	2.09	2.15	2.22	2.29	2.35	2.42	2.49	2.57	3.04	3.10	3.15	3.15	3.15
sw by w	2.53	3.02	3.10	3.19	3.27	3.36	3.46	3.55	4.05	4.13	4.20	4.20	4.20
sw	3.47	3.57	4.08	4.18	4.29	4.39	4.51	5.03					
sw by s	4.50	5.02	5.14	5.26									
West	6.00												
☉ set	6.00	5.52	5.44	5.36	5.28	5.19	5.10	5.01	4.51	4.44	4.38	4.38	4.38

A Sun-Dial for the Latitude of 40 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.15	0.14
s s w	1.00	0.57	0.53	0.50	0.47	0.44	0.41	0.37	0.34	0.31	0.29
sw by s	1.33	1.28	1.24	1.19	1.14	1.09	1.04	0.59	0.54	0.49	0.46
s w	2.11	2.04	1.58	1.51	1.45	1.38	1.31	1.24	1.17	1.11	1.06
sw by w	2.56	2.47	2.39	2.30	2.22	2.14	2.04	1.55	1.46	1.38	1.31
w s w	3.49	3.39	3.29	3.18	3.08	2.58	2.46	2.35	2.23	2.13	2.05
w by s	4.51	4.40	4.28	4.17	4.05	3.53	3.40	3.27	3.13	3.02	2.51
West	6.00	5.48	5.36	5.25	5.11	4.59	4.46	4.32	4.17	4.05	3.55
w by n					6.23	6.11	5.58	5.45	5.31	5.19	5.10
w n w								6.58	6.46	6.36	6.28
☉ set	6.00	6.08	6.17	6.25	6.34	6.43	6.52	7.01	6.11	7.19	7.25
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	3.15	6.32	9.48	13.6	16.24	19.45	23.06	26.30	29.16	31.22

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.42	0.43	0.41
s s w	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.22	1.25	1.28	1.30
sw by s	1.33	1.38	1.43	1.47	1.52	1.57	2.02	2.07	2.12	2.17	2.20
s w	2.11	2.17	2.24	2.31	2.37	2.44	2.51	2.58	3.05	3.11	3.16
sw by w	2.56	3.04	3.12	3.21	3.29	3.38	3.47	3.56	4.06	4.14	4.20
w s w	3.49	3.59	4.09	4.19	4.30	4.40	4.41	5.03			
w by s	4.51	5.03	5.14	5.26							
West	6.00										
☉ set	6.00	5.52	5.43	5.35	5.26	5.17	5.08	4.59	4.49	4.41	4.35

A Sun-Dial for the Latitude of 41 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.30	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.17	0.16	0.15
s w	1.01	0.58	0.55	0.52	0.49	0.46	0.42	0.39	0.36	0.33	0.31
by s	1.35	1.30	1.25	1.21	1.16	1.11	1.06	1.01	0.56	0.52	0.48
s w	2.13	2.07	2.00	1.54	1.48	1.41	1.34	1.27	1.27	1.14	1.09
by w	2.58	2.50	2.42	2.33	2.25	2.17	2.08	1.59	1.59	1.42	1.36
s w	3.51	3.41	3.31	3.21	3.11	3.01	2.50	2.39	2.28	2.18	2.11
by s	4.53	4.42	4.30	4.19	4.08	3.57	3.44	3.31	3.18	3.07	2.58
West	5.00	5.48	5.36	5.25	5.13	5.01	4.48	4.35	4.21	4.09	4.00
by w					6.23	6.12	5.59	5.46	5.33	5.22	5.13
w n w								5.58	6.46	6.37	6.29
☉ set	6.00	6.09	5.17	6.26	5.35	6.44	5.54	7.04	7.14	7.22	7.29
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Ampl	0.00	3.18	5.38	0.57	13.18	16.40	20.4	23.29	26.56	29.45	31.54

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.30	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.44	0.45
s w	1.01	1.04	1.07	1.10	1.13	1.16	1.19	1.23	1.26	1.29	1.31
by s	1.35	1.39	1.44	1.49	1.53	1.58	2.03	2.08	2.13	2.18	2.21
s w	2.13	2.19	2.26	2.32	2.39	2.45	2.52	2.59	3.06	3.12	3.17
by w	2.58	3.06	3.14	3.22	3.31	3.39	3.48	3.57	4.06	4.14	4.20
w s w	3.51	4.01	4.11	4.21	4.30	4.40	4.51	5.03			
by s	4.53	5.04	5.15	5.26							
West	6.00										
☉ set	6.00	5.51	5.43	5.34	5.25	5.16	5.06	4.56	4.46	4.38	3.31

*A Sun-Dial for the Latitude of 42 Degrees.***North Declination.**

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.16
s s w	1.02	0.59	0.56	0.53	0.50	0.47	0.44	0.41	0.37	0.34	0.32
sw by s	1.36	1.32	1.27	1.23	1.18	1.13	1.09	1.04	0.58	0.54	0.51
s w	2.15	2.09	2.03	1.56	1.50	1.44	1.37	1.30	1.23	1.17	1.13
sw by w	2.00	2.52	2.44	2.36	2.28	2.20	2.12	2.03	1.54	1.46	1.40
w s w	3.53	3.43	3.34	3.24	3.15	3.05	2.54	2.44	2.33	2.23	2.16
w by s	4.54	4.43	4.32	4.21	4.10	4.00	3.48	3.36	3.23	3.12	3.03
West	6.00	5.49	5.37	5.26	5.15	5.03	4.51	4.39	4.24	4.13	4.04
w by n					6.23	6.12	6.00	5.48	5.38	5.24	5.16
w n w								6.58	6.47	6.37	6.30
☉ set	6.00	5.00	6.18	6.27	6.37	6.46	6.56	7.06	7.17	7.25	7.32
Sun's d m	1 d m	1 d m	1 d m	1 d m	1 d m	1 d m	1 d m	1 d m	1 d m	1 d m	1 d m
Ampl	0 00	3.21	6.44	10.6	13.31	16.56	20.23	23.52	27.24	30.16	32.28

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.32	0.33	0.35	0.36	0.38	0.39	0.41	0.43	0.44	0.45
s s w	1.02	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.27	1.30	1.32
sw by s	1.36	1.41	1.46	1.50	1.55	1.59	2.04	2.09	2.14	2.19	2.22
s w	2.15	2.21	2.28	2.34	2.40	2.46	2.53	3.00	3.07	3.13	3.17
sw by w	2.00	3.08	3.16	3.24	3.32	3.40	3.49	3.57	4.07	4.14	4.20
w s w	3.53	4.02	4.12	4.22	4.31	4.41	4.52				
w by s	4.54	5.04	5.15	5.26							
West.	6.00										
☉ set	6.00	5.51	5.42	5.33	5.23	5.14	5.04	4.54	4.43	4.35	4.28

A Sun-Dial for the Latitude of 43 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.29	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.18	0.17
s s w	1.03	1.00	0.57	0.54	0.51	0.48	0.45	0.42	0.39	0.36	0.34
sw by s	1.38	1.34	1.29	1.25	1.20	1.15	1.11	1.06	1.01	0.57	0.53
s w	2.17	2.11	2.05	1.59	1.53	1.47	1.40	1.33	1.26	1.20	1.16
sw by w	3.02	2.55	2.47	2.39	2.31	2.23	2.15	2.07	1.58	1.50	1.44
w s w	3.55	3.46	3.36	3.27	3.18	3.08	2.58	2.48	2.37	2.28	2.21
w by s	4.55	4.45	4.34	4.23	4.13	4.03	3.52	3.40	3.27	3.17	3.09
West	6.00	5.49	5.38	5.27	5.16	5.05	4.53	4.41	4.27	4.17	4.09
w by n					6.23	6.13	6.01	5.50	5.37	5.27	5.19
w n w								6.58	6.47	6.38	6.31
☉ set	6.00	6.09	6.19	6.28	6.38	6.48	6.58	7.09	7.19	7.28	7.36
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl	0.00	3.25	6.51	10.17	13.44	17.13	20.43	24.16	27.53	30.48	52.03

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.41	0.43	0.44	0.45
s s w	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27	1.30	1.32
sw by s	1.38	1.42	1.47	1.52	1.56	2.01	2.05	2.10	2.15	2.19	2.23
s w	2.17	2.23	2.29	2.36	2.42	2.48	2.54	3.01	3.08	3.14	3.18
sw by w	3.02	3.10	3.18	3.26	3.33	3.41	3.50	3.58	4.07	4.14	4.20
w s w	3.55	4.04	4.14	4.23	4.32	4.42	4.52				
w by s	4.55	5.05	5.16	5.26							
West	6.00										
☉ set	6.00	5.51	5.44	5.32	5.22	5.12	5.02	4.51	4.41	4.32	4.24

A Sun-Dial for the Latitude of 44 Degrees.

North Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.18	0.17
s s w	1.04	1.01	0.58	0.56	0.53	0.50	0.47	0.44	0.40	0.38	0.36
sw by s	1.40	1.35	1.31	1.27	1.22	1.18	1.13	1.08	1.03	0.59	0.56
s w	2.19	2.13	2.07	2.01	1.55	1.49	1.43	1.36	1.29	1.24	1.20
swbw	3.04	2.57	2.49	2.42	2.34	2.26	2.18	2.10	2.01	1.54	1.49
w s w	3.57	3.48	3.38	3.29	3.21	3.12	3.02	2.52	2.41	2.33	2.26
w by s	4.56	4.46	4.36	4.26	4.16	4.05	3.54	3.43	3.31	3.21	3.13
West	6.00	5.50	5.39	5.28	5.18	5.07	4.56	4.44	4.31	4.21	4.13
w by n					6.23	6.13	6.02	5.51	5.39	5.29	5.21
w n w								6.59	6.48	6.39	6.32
☉ set	6.00	5.10	6.19	6.29	6.39	6.49	7.00	7.11	7.22	7.31	7.39
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d n
Ampl	0.00	1.28	6.58	10.27	13.58	17.30	21.5	24.42	28.23	31.22	33.40

South Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46
s s w	1.04	1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.28	1.31	1.33
sw by s	1.40	1.44	1.48	1.53	1.57	2.02	2.06	2.11	2.16	2.20	2.23
s w	2.19	2.25	2.31	2.37	2.43	2.49	2.56	3.02	3.09	3.14	3.19
swbw	3.04	3.12	3.19	3.27	3.35	3.42	3.51	3.59	4.08	4.15	4.20
w s w	3.57	4.06	4.15	4.24	4.33	4.42	4.52				
w by s	4.56	5.06	5.16	5.26							
West.	6.00										
☉ set	6.00	5.50	5.41	5.31	5.21	5.11	5.00	4.49	4.38	4.29	4.21

A Sun-Dial for the Latitude of 45 Degrées.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by n	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.22	0.20	0.19	0.18
s s w	1.05	1.03	1.00	0.57	0.54	0.51	0.48	0.45	0.42	0.39	0.37
sw by s	1.41	1.37	1.33	1.28	1.24	1.19	1.15	1.10	1.05	1.01	0.58
s w	2.21	2.11	2.09	2.03	1.58	1.52	1.45	1.39	1.33	1.27	1.23
sw by w	3.06	2.59	2.52	2.45	2.37	2.29	2.22	2.13	2.05	1.58	1.53
w s w	3.59	3.50	3.41	3.32	3.23	3.14	3.05	2.55	2.45	2.37	2.30
w by s	4.57	4.47	4.38	4.28	4.18	4.08	3.57	3.46	3.35	3.26	3.18
West	6.00	5.50	5.40	5.30	5.19	5.09	4.58	4.46	4.35	4.25	4.17
w by n					6.24	6.14	6.03	5.52	5.41	5.31	5.24
w n w								6.59	6.48	6.40	6.33
nw by w											7.40
☉ set	6.00	6.10	6.20	6.30	6.41	6.51	7.02	7.13	7.25	7.35	7.43
Sun's d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d	m d
Ampl	0.00	3.32	7.05	10.38	14.13	17.49	21.28	25.9	28.56	31.58	34.20

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.32	0.33	0.35	0.36	0.38	0.39	0.41	0.42	0.44	0.45	0.46
s s w	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.31	1.33
sw by s	1.41	1.45	1.50	1.54	1.58	2.03	2.07	2.12	2.17	2.21	2.24
s w	2.21	2.27	2.33	2.39	2.44	2.51	2.57	3.03	3.10	3.15	3.19
sw by w	3.06	3.14	3.21	3.28	3.36	3.44	3.51	4.00	4.08	4.15	
w s w	3.59	4.07	4.16	4.25	4.34	4.43	4.52				
w by s	4.57	5.07	5.17	5.26							
West	6.00										
☉ set	6.00	5.50	5.40	5.30	5.19	5.09	4.58	4.47	4.35	4.25	4.17

A Sun-Dial for the Latitude of 46 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.31	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19
s s w	1.06	1.04	1.01	0.58	0.55	0.52	0.49	0.46	0.43	0.41	0.39
sw by s	1.43	1.38	1.34	1.30	1.26	1.21	1.17	1.12	1.08	1.04	1.01
s w	2.23	2.17	2.11	2.06	2.00	1.54	1.48	1.42	1.36	1.30	1.26
sw by w	3.08	3.01	2.54	2.47	2.40	2.32	2.25	2.17	2.09	2.02	1.57
w s w	4.00	3.52	3.43	3.35	3.26	3.17	3.08	2.59	2.49	2.41	2.35
w by s	5.58	4.49	4.39	4.30	4.20	4.11	4.00	3.50	3.39	3.30	3.23
West	6.00	5.50	5.40	5.30	5.20	5.11	5.00	4.49	4.38	4.28	4.21
w by n					6.24	6.14	6.04	5.54	5.43	5.33	5.26
w n w								6.59	6.49	6.41	6.34
nw by w											7.40
☉ set	6.00	6.10	6.21	6.31	6.42	6.53	7.04	7.16	7.29	7.39	7.47
Sun's Ampl.	0.00	3.36	7.12	10.50	14.28	18.0	21.52	25.39	29.31	32.37	35.3

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.34	0.35	0.37	0.38	0.40	0.41	0.42	0.44	0.45	0.46
s s w	1.06	1.09	1.12	1.15	1.18	1.20	1.23	1.26	1.29	1.32	1.34
sw by s	1.43	1.47	1.51	1.55	2.00	2.04	2.08	2.13	2.18	2.22	2.25
s w	2.23	2.29	2.34	2.40	2.46	2.52	2.58	3.04	3.10	3.16	3.20
sw by w	3.08	3.16	3.23	3.30	3.37	3.45	3.52	4.00	4.08	4.15	
w s w	4.00	4.09	4.17	4.26	4.34	4.43					
w by s	4.58	5.08	5.17	5.26							
West	6.00										
☉ set	6.00	5.50	5.39	5.29	5.18	5.07	4.56	4.44	4.31	4.21	4.13

A Sun-Dial for the Latitude of 47 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.23	0.22	0.21	0.20
s s w	1.07	1.05	1.02	0.59	0.56	0.54	0.51	0.48	0.45	0.42	0.40
sw by s	1.44	1.40	1.36	1.32	1.28	1.23	1.19	1.15	1.10	1.06	1.03
s w	2.25	2.19	2.14	2.08	2.02	1.57	1.51	1.45	1.39	1.33	1.29
sw by w	3.10	3.03	2.56	2.49	2.43	2.35	2.28	2.20	2.13	2.06	2.01
w s w	4.02	3.54	3.46	3.37	3.29	3.20	3.12	3.03	2.53	2.45	2.39
w by s	4.59	4.50	4.41	4.32	4.23	4.13	4.03	3.53	3.43	3.34	3.27
West	6.00	5.51	5.41	5.32	5.22	5.12	5.02	4.52	4.41	4.31	4.24
w by n				6.34	6.25	6.15	6.05	5.55	5.44	5.36	5.29
w n w							7.08	6.59	6.49	6.41	6.35
n w by w											7.40
☉ set	6.00	6.11	6.22	6.33	6.43	6.55	7.07	7.20	7.32	7.43	7.51
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl	0.00	3.40	7.20	11.2	14.44	18.30	22.18	26.10	30.7	33.18	35.48

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.34	0.36	0.37	0.38	0.40	0.41	0.43	0.44	0.45	0.46
s s w	1.07	1.10	1.13	1.16	1.18	1.21	1.24	1.27	1.30	1.32	1.34
sw by s	1.44	1.48	1.52	1.57	2.01	2.05	2.09	2.14	2.18	2.22	2.25
s w	2.25	2.30	2.36	2.41	2.47	2.53	2.59	3.05	3.11	3.16	3.20
sw by w	3.10	3.17	3.24	3.31	3.38	3.45	3.53	4.00	4.08	4.15	
w s w	4.02	4.10	4.18	4.26	4.35	4.43					
w by s	4.59	5.08	5.17								
West	6.00										
☉ set	6.00	5.49	5.38	5.27	5.17	5.05	4.53	4.40	4.28	4.13	4.09

A Sun-Dial for the Latitude of 48 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.32	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21
s s w	1.08	1.06	1.03	1.00	0.58	0.55	0.52	0.49	0.46	0.44	0.42
sw by s	1.46	1.42	1.38	1.34	1.30	1.25	1.21	1.17	1.12	1.08	1.05
s w	2.27	2.21	2.16	2.10	2.05	1.59	1.53	1.47	1.41	1.36	1.32
sw by w	3.12	3.06	2.59	2.52	2.46	2.38	2.31	2.23	2.16	2.09	2.04
w s w	4.03	3.56	3.48	3.40	3.32	3.23	3.15	3.06	2.57	2.49	2.43
w by s	5.00	4.51	4.43	4.34	4.25	4.16	4.06	3.56	3.46	3.38	3.31
West	6.00	5.51	5.42	5.33	5.23	5.14	5.04	4.54	4.43	4.35	4.28
w by n				6.34	6.25	6.16	6.06	5.56	5.46	5.38	5.31
w n w							7.08	6.59	6.50	6.42	6.36
nw by w										7.45	7.40
☉ set	6.00	6.11	6.22	6.33	6.45	6.57	7.09	7.22	7.35	7.47	7.56
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0.00	3.44	7.20	11.15	15.2	18.52	22.45	26.43	30.45	34.3	36.35

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.35	0.36	0.38	0.39	0.40	0.42	0.43	0.45	0.46	0.47
s s w	1.08	1.11	1.14	1.16	1.19	1.22	1.25	1.28	1.31	1.33	1.35
sw by s	1.46	1.50	1.54	1.58	2.02	2.06	2.10	2.15	2.19	2.23	2.26
s w	2.27	2.32	2.37	2.43	2.48	2.54	3.00	3.05	3.12	3.17	3.21
sw by w	3.12	3.19	3.26	3.32	3.39	3.45	3.53	4.01	4.09		
w s w	4.03	4.11	4.19	4.27	4.35	4.44					
w by s	5.00	5.09	5.17	5.26							
West	6.00										
☉ set	6.00	5.49	5.38	5.27	5.15	5.03	4.51	4.38	4.25	4.13	4.04

A Sun-Dial for the Latitude of 49 Degrees.

North Declination.

23 d	Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d	
29 m	Min.	30 m			30 m			30 m			29 m		
h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	
12	South	12	12	12	12	12	12	12	12	12	12	12	
0.21	s by w	0.34	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.23	0.22	0.21	
0.42	s s w	1.09	1.07	1.04	1.02	0.59	0.56	0.53	0.51	0.48	0.45	0.43	
1.05	s by s	1.47	1.43	1.39	1.35	1.31	1.27	1.23	1.19	1.14	1.11	1.08	
1.32	s w	2.28	2.23	2.18	2.12	2.07	2.01	1.56	1.50	1.44	1.39	1.35	
2.04	s by w	3.14	3.07	3.01	2.54	2.48	2.41	2.34	2.27	2.19	2.13	2.08	
2.43	w s w	4.05	3.57	3.50	3.42	3.34	3.26	3.18	3.09	3.00	2.53	2.47	
3.31	w by s	5.01	4.53	4.44	4.36	4.27	4.18	4.09	4.00	3.50	3.42	3.35	
4.28	West	6.00	5.51	5.42	5.34	5.25	5.16	5.06	4.56	4.46	4.38	4.31	
5.31	w by n				6.34	6.25	6.10	6.07	5.58	5.48	5.40	5.33	
6.36	w n w							7.08	7.00	6.51	6.43	6.38	
7.40	n w b w										7.45	7.40	
7.56	☉ set	6.00	6.11	6.23	6.34	6.47	6.59	7.12	7.25	7.39	7.51	8.00	
d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	
36.35	Amp.	0.00	3.18	7.38	11.28	15.21	19.15	23.14	27.17	31.25	34.38	37.26	

South Declination.

23 d	Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
29m	Min.		30m		30m		30m		30m			29m
h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	South	12	12	12	12	12	12	12	12	12	12	12
0.47	s by w	0.34	0.35	0.37	0.38	0.39	0.41	0.42	0.43	0.45	0.46	0.47
0.35	s s w	1.09	1.12	1.15	1.17	1.20	1.23	1.25	1.28	1.31	1.33	1.35
0.26	s w by s	1.47	1.51	1.55	1.59	2.03	2.07	2.11	2.15	2.20	2.23	2.20
0.21	s w	2.28	2.33	2.39	2.44	2.49	2.55	3.00	3.06	3.12	3.17	3.21
	s w by w	3.14	3.20	3.27	3.34	3.40	3.47	3.54	4.01	4.09		
	w s w	4.05	4.13	4.20	4.28	4.36	4.44					
	w by s	5.01	5.09	5.18								
	West	6.00										
	☉ set	6.00	5.49	5.37	5.26	5.13	5.01	4.48	4.35	4.21	4.09	4.00
04												

A Sun-Dial for the Latitude of 50 Degrees.

North Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22
s s w	1.10	1.08	1.05	1.03	1.00	0.58	0.55	0.52	0.49	0.47	0.45
sw by s	1.48	1.45	1.41	1.37	1.33	1.29	1.25	1.21	1.16	1.13	1.10
s w	2.30	2.25	2.20	2.15	2.09	2.04	1.58	1.53	1.47	1.42	1.37
sw by w	3.16	3.09	3.03	2.56	2.50	2.43	2.36	2.30	2.23	2.16	2.10
w s w	4.06	3.59	3.51	3.44	3.36	3.29	3.21	3.13	3.04	2.57	2.50
w by s	5.02	4.54	4.45	4.37	4.29	4.20	4.12	4.03	3.53	3.45	3.37
West	6.00	5.52	5.43	5.34	5.26	5.17	5.08	4.59	4.49	4.41	4.33
w by n				5.31	6.25	6.17	6.08	5.59	5.49	5.42	5.34
w n w							7.08	7.00	6.51	6.44	6.37
nw by w										7.45	7.40
☉ set	6.00	5.12	6.24	6.36	6.49	7.01	7.14	7.28	7.43	7.55	8.00
Sun's Ampl	0.00	3.53	7.48	11.42	15.40	19.40	23.45	27.53	32.8	35.37	38.20

South Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.36	0.37	0.38	0.40	0.41	0.42	0.44	0.45	0.46	0.47
s s w	1.10	1.13	1.15	1.18	1.21	1.23	1.26	1.29	1.32	1.34	1.36
sw by s	1.48	1.52	1.56	2.00	2.04	2.08	2.12	2.16	2.20	2.24	2.27
s w	2.30	2.35	2.40	2.45	2.50	2.56	3.01	3.07	3.13	3.17	3.21
sw by w	3.16	3.22	3.28	3.35	3.41	3.48	3.55	4.02	4.09		
w s w	4.06	4.14	4.21	4.29	4.36	4.44					
w by s	5.02	5.10	5.18								
West	6.00										
☉ set	6.00	5.48	5.36	5.24	5.11	4.59	4.46	4.32	4.17	4.05	3.55

A Sun-Dial for the Latitude of 51 Degrees.

North Declination.

Deg.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Min.		30m		30n		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24	0.23
s w	1.11	1.09	1.06	1.04	1.01	0.59	0.56	0.53	0.51	0.48	0.47
sw by s	1.50	1.46	1.42	1.39	1.35	1.31	1.27	1.23	1.19	1.15	1.12
s w	2.31	2.26	2.21	2.16	2.11	2.06	2.01	1.55	1.50	1.45	1.41
sw by w	3.17	3.11	3.05	2.59	2.52	2.46	2.39	2.33	2.26	2.20	2.15
w s w	4.08	4.01	3.53	3.46	3.39	3.31	3.24	3.16	3.08	3.01	2.55
sw by s	5.03	4.55	4.47	4.39	4.31	4.22	4.14	4.05	3.56	3.49	3.43
West	6.00	5.52	5.46	5.35	5.27	5.18	5.10	5.01	4.52	4.44	4.37
w by n				6.34	6.26	6.17	6.09	6.00	5.51	5.44	5.38
n w							7.08	7.00	6.52	6.45	6.40
nw by w										7.45	7.41
☉ set	6.00	6.12	6.25	6.38	6.50	7.03	7.17	7.32	7.47	8.00	8.10
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	3.58	7.58	11.57	16.11	20.8	24.18	28.33	32.54	36.30	39.19

South Declination.

Deg.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.36	0.38	0.39	0.40	0.41	0.42	0.44	0.46	0.47	0.48
s s w	1.11	1.14	1.16	1.19	1.21	1.24	1.27	1.29	1.32	1.34	1.36
sw by s	1.50	1.53	1.57	2.01	2.05	2.09	2.13	2.17	2.21	2.24	2.27
s w	2.31	2.36	2.41	2.46	2.52	2.57	3.02	3.07	3.13	3.18	3.21
sw by w	3.17	3.23	3.30	3.36	3.42	3.49	3.55	4.02	4.09		
w s w	4.08	4.15	4.22	4.29	4.37	4.44					
sw by s	5.03	5.10	5.18								
West	6.00										
☉ set	6.00	5.48	5.35	5.22	5.10	4.57	4.43	4.28	4.13	4.00	3.50

A Sun-Dial for the Latitude of 52 Degrees.

North Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.25	0.24
s s w	1.12	1.10	1.08	1.05	1.03	1.00	0.57	0.55	0.52	0.50	0.48
sw by s	1.51	1.47	1.44	1.40	1.36	1.33	1.29	1.25	1.21	1.17	1.13
s w	2.35	2.28	2.23	2.18	2.13	2.08	2.03	1.58	1.52	1.48	1.44
sw by w	3.19	3.13	3.07	2.01	2.55	2.48	2.42	2.36	2.29	2.24	2.18
w s w	4.09	4.02	3.55	3.48	3.41	3.34	3.26	3.19	3.11	3.04	2.57
w by s	5.03	4.56	4.48	4.40	4.33	4.25	4.16	4.08	3.59	3.52	3.44
West	6.00	5.52	5.44	5.36	5.28	5.20	5.12	5.03	4.54	4.46	4.38
w by n				5.34	6.26	6.18	6.10	6.01	5.53	5.45	5.37
w n w							7.08	7.00	6.53	6.46	6.38
nw by w										7.45	7.37
☉ set	6.00	6.13	6.26	6.39	6.52	7.06	7.20	7.35	7.51	8.05	8.19
Sun's	d	md	md	md	md	md	md	md	md	md	md
Ampl	0.00	4.07	8.08	12.13	16.23	20.35	24.32	29.14	33.44	37.27	40.23

South Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.37	0.38	0.39	0.41	0.42	0.43	0.44	0.46	0.47	0.48
s s w	1.12	1.15	1.17	1.20	1.22	1.25	1.27	1.30	1.33	1.35	1.37
sw by s	1.51	1.55	1.58	2.02	2.06	2.10	2.13	2.17	2.22	2.25	2.28
s w	2.33	2.38	2.43	2.48	2.53	2.58	3.03	3.08	3.13	3.18	3.22
sw by w	3.19	3.25	3.31	3.37	3.43	3.49	3.56	4.02	4.10		
w s w	4.09	4.16	4.23	4.30	4.37	4.44					
w by s	5.03	5.11	5.19								
West	6.00										
☉ set	6.00	5.47	5.34	5.21	5.08	4.54	4.35	4.20	4.00	3.55	3.44

A Sun-Dial for the Latitude of 53 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.36	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24
s w	1.13	1.11	1.08	1.06	1.04	1.01	0.59	0.56	0.53	0.51	0.50
by s	1.52	1.49	1.45	1.41	1.38	1.34	1.31	1.27	1.23	1.19	1.17
s w	2.34	2.30	2.25	2.20	2.15	2.10	2.05	2.00	1.55	1.51	1.47
by w	3.20	3.15	3.09	3.03	2.57	2.51	2.45	2.38	2.32	2.26	2.22
s w	4.10	4.04	3.57	3.50	3.43	3.36	3.29	3.22	3.14	3.08	3.03
by s	5.04	4.57	4.49	4.42	4.34	4.27	4.19	4.11	4.02	3.55	3.50
West	6.00	5.52	5.45	5.37	5.29	5.22	5.13	5.05	4.56	4.49	4.43
by n				6.34	6.26	6.19	6.11	6.03	5.54	5.47	5.42
n w							7.08	7.01	6.53	6.47	6.42
by w									7.51	7.46	7.42
☉ set	6.00	6.14	6.27	6.41	6.54	7.08	7.23	7.39	7.56	8.10	8.21
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	4.09	8.19	12.31	16.46	21.5	25.28	29.59	34.39	38.29	41.29

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.36	0.37	0.38	0.40	0.41	0.42	0.43	0.45	0.46	0.47	0.48
s w	1.13	1.16	1.18	1.20	1.23	1.25	1.28	1.30	1.33	1.35	1.37
by s	1.52	1.56	2.00	2.03	2.07	2.10	2.14	2.18	2.22	2.25	2.28
s w	2.34	2.39	2.44	2.49	2.54	2.58	3.03	3.09	3.14	3.18	3.22
by w	3.20	3.26	3.32	3.38	3.44	3.50	3.56	4.12			
s w	4.10	4.17	4.24	4.30	4.37	4.44					
by s	5.04	5.11	5.19								
West	6.00										
☉ set	6.00	5.46	5.33	5.19	5.06	4.52	4.37	4.21	4.04	3.50	3.39

A Sun-Dial for the Latitude of 54 Degrees.

North Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.35	0.34	0.33	0.32	0.31	0.29	0.28	0.27	0.26	0.25
s s w	1.14	1.12	1.09	1.07	1.05	1.02	1.00	0.57	0.55	0.53	0.51
sw by s	1.54	1.50	1.47	1.43	1.40	1.36	1.32	1.29	1.25	1.22	1.19
s w	2.36	2.31	2.27	2.22	2.17	2.12	2.08	2.03	1.57	1.53	1.50
sw b w	3.22	3.16	3.11	3.05	2.59	2.53	2.47	2.41	2.35	2.29	2.23
w s w	4.12	4.05	3.59	3.52	3.45	3.39	3.32	3.24	3.17	3.11	3.05
w by s	5.05	4.58	4.51	4.43	4.36	4.29	4.21	4.13	4.05	3.58	3.51
West	6.00	5.53	5.45	5.38	5.31	5.23	5.15	5.07	4.59	4.52	4.45
w by n				6.34	6.27	6.19	6.12	6.04	5.56	5.49	5.41
w n w							7.09	7.01	6.54	6.48	6.41
nw by w									7.51	7.56	7.48
☉ let	6.00	6.14	6.28	6.42	6.56	7.11	7.27	7.43	8.00	8.15	8.27
Sun's d m											
Amp.	0.00	4.15	8.31	12.49	17.11	21.36	26.7	30.46	35.35	39.26	42.40

South Declination.

Deg. Min.	0	d 2	d 5	d 7	d 10	d 12	d 15	d 17	d 20	d 22	d 23
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.38	0.39	0.40	0.41	0.42	0.44	0.45	0.46	0.47	0.48
s s w	1.14	1.16	1.19	1.21	1.24	1.26	1.28	1.31	1.33	1.35	1.37
sw by s	1.54	1.57	2.01	2.04	2.03	2.11	2.15	2.19	2.23	2.26	2.28
s w	2.36	2.41	2.45	2.50	2.54	2.59	3.04	3.09	3.15	3.19	3.22
sw by w	3.22	3.27	3.33	3.39	3.44	3.50	3.56	4.03			
w s w	4.12	4.18	4.24	4.31	4.38	4.45					
w by s	5.05	5.12	5.19								
West	6.00										
☉ let	6.00	5.46	5.32	5.18	5.04	4.49	4.33	4.17	4.00	3.45	3.35

A Sun-Dial for the Latitude of 55 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m		30m		30m		29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.37	0.36	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.27	0.26
sw	1.15	1.13	1.10	1.08	1.06	1.03	1.01	0.59	0.56	0.54	0.52
sw by s	1.55	1.51	1.48	1.45	1.41	1.38	1.34	1.30	1.27	1.23	1.21
sw	2.37	2.33	2.28	2.24	2.19	2.14	2.10	2.05	2.00	1.55	1.52
sw by w	3.23	3.18	3.12	3.07	3.01	2.56	2.50	2.44	2.38	2.33	2.29
sw	4.13	4.06	4.00	3.54	3.47	3.41	3.34	3.27	3.20	3.14	3.10
sw by s	5.05	4.59	4.52	4.45	4.38	4.31	4.23	4.16	4.08	4.02	3.56
West	6.00	5.53	5.46	5.39	5.32	5.24	5.17	5.09	5.01	5.54	4.49
sw by n				6.34	6.27	6.20	6.13	6.05	5.57	5.51	5.46
sw n w							7.09	7.02	6.55	6.49	6.44
sw by w									7.51	7.46	7.42
☉ set	6.00	6.14	6.29	6.43	6.58	7.14	7.30	7.47	8.05	8.21	8.33
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	4.21	3.44	3.9	17.37	22.10	26.49	31.37	36.36	40.47	44.0

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.	30m		30m		30m		30m		30m		29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.45	0.46	0.47	0.48
sw	1.15	1.17	1.20	1.22	1.24	1.26	1.29	1.31	1.34	1.36	1.38
sw by s	1.55	1.58	2.01	2.05	2.08	2.12	2.16	2.19	2.23	2.26	2.29
sw	2.37	2.42	2.46	2.51	2.55	3.00	3.05	3.10	3.15	3.19	3.22
sw by w	3.23	3.29	3.34	3.40	3.45	3.51	3.57	4.03			
sw	4.13	4.19	4.25	4.32	4.38	4.45					
sw by s	5.05	5.12	5.19								
West	6.00										
☉ set	6.00	5.46	5.31	5.17	5.02	4.46	4.30	4.13	3.55	3.39	3.20

A Sun-Dial for the Latitude of 56 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26
s s w	1.16	1.14	1.11	1.09	1.07	1.05	1.02	1.00	0.57	0.55	0.53
sw by s	1.56	1.53	1.49	1.46	1.43	1.39	1.36	1.32	1.28	1.26	1.23
s w	2.39	2.34	2.30	2.26	2.21	2.16	2.12	2.07	2.02	1.59	1.55
sw by w	3.25	3.19	3.14	3.09	3.03	2.58	2.52	2.46	2.40	2.36	2.32
w s w	4.14	4.08	4.02	3.56	3.50	3.43	3.37	3.30	3.23	3.17	3.13
w by s	5.06	5.00	4.53	4.46	4.40	4.33	4.26	4.18	4.11	4.05	4.00
West	6.00	5.53	5.46	5.39	5.32	5.26	5.18	5.11	5.03	4.57	4.51
w by n				6.34	6.28	6.21	6.14	6.06	5.59	5.53	5.48
w n w						7.15	7.09	7.02	6.55	6.50	6.45
n w by w									7.51	7.46	7.41
(○) set	6.00	6.15	6.30	6.45	7.00	7.16	7.34	7.52	8.10	8.27	8.41
Sun's d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0 00	1.28	3.57	13.29	18.5	22.46	27.34	32.32	37.42	42.4	45.27

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.47	0.48	0.48
s s w	1.16	1.18	1.20	1.22	1.25	1.27	1.29	1.32	1.34	1.36	1.38
sw by s	1.56	1.59	2.02	2.06	2.09	2.13	2.16	2.20	2.24	2.26	2.29
s w	2.39	2.43	2.47	2.52	2.56	3.01	3.06	3.10	3.15	3.19	—
sw by w	3.25	3.30	3.35	3.40	3.46	3.51	3.57	4.03	—	—	—
w s w	4.14	4.20	4.26	4.32	4.38	—	—	—	—	—	—
w by s	5.06	5.13	5.19	—	—	—	—	—	—	—	—
West	6.00	—	—	—	—	—	—	—	—	—	—
(○) set	6.00	5.45	5.30	5.15	5 00	4.44	4.26	4.08	3.50	3.33	3.10

A Sun-Dial for the Latitude of 57 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.38	0.37	0.36	0.35	0.34	0.32	0.31	0.30	0.29	0.28	0.27
s w	1.17	1.14	1.12	1.10	1.08	1.06	1.04	1.01	0.59	0.57	0.55
by s	1.57	1.54	1.51	1.47	1.44	1.41	1.37	1.34	1.30	1.27	1.25
s w	2.40	2.36	2.32	2.27	2.23	2.18	2.14	2.10	2.05	2.01	1.58
by w	3.26	3.21	3.16	3.11	3.05	3.00	2.55	2.49	2.43	2.38	2.35
s w	4.15	4.09	4.03	3.57	3.51	3.45	3.39	3.33	3.26	3.20	3.16
by s	5.07	5.00	4.54	4.47	4.41	4.34	4.28	4.21	4.13	4.07	4.03
West	6.00	5.53	5.47	5.40	5.33	5.27	5.20	5.12	5.05	4.59	4.54
by n				6.34	6.28	6.21	6.14	6.07	6.00	5.54	5.50
new						7.15	7.09	7.03	6.56	6.51	6.46
by w									7.52	7.47	7.43
n w											8.38
☉ set	0.00	5.16	6.31	6.47	7.03	7.20	7.38	7.50	8.10	8.34	8.48
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Amp.	0.00	4.35	9.11	13.52	18.33	23.24	28.22	33.31	38.53	43.27	47.2

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
by w	0.38	0.39	0.40	0.41	0.42	0.43	0.44	0.46	0.47	0.48	0.49
s w	1.17	1.19	1.21	1.23	1.25	1.27	1.30	1.32	1.34	1.36	1.38
by s	1.57	2.00	2.03	2.07	2.10	2.13	2.17	2.20	2.24	2.27	2.29
s w	2.40	2.44	2.48	2.53	2.57	3.02	3.06	3.10	3.15	3.19	
by w	3.26	3.31	3.36	3.41	3.46	3.51	3.57	4.03			
s w	5.15	4.21	4.26	4.32	4.38						
by s	5.07	5.13	5.19								
West	6.00										
☉ set	6.00	6.44	6.29	5.13	4.57	4.40	4.22	4.04	3.44	3.22	3.10

A Sun-Dial for the Latitude of 58 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28
s s w	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.02	1.00	0.58	0.57
sw by s	1.58	1.55	1.52	1.49	1.46	1.42	1.39	1.36	1.32	1.29	1.27
s w	2.41	2.37	2.33	2.29	2.25	2.20	2.16	2.12	2.07	2.04	2.01
sw by w	3.27	3.22	3.17	3.12	3.07	3.02	2.57	2.51	2.46	2.41	2.38
w s w	4.16	4.10	4.05	3.59	3.53	3.47	3.41	3.35	3.29	3.23	3.19
w by s	5.07	5.01	4.55	4.49	4.43	4.36	4.30	4.23	4.16	4.10	4.06
West	6.00	5.54	5.47	5.41	5.34	5.28	5.21	5.14	5.08	5.02	4.57
w by n				6.34	6.28	6.22	6.15	6.08	6.02	5.56	5.51
w n w						7.16	7.10	7.03	6.57	6.52	6.48
n w by w								7.57	7.52	7.47	7.44
n w											8.38
☉ set	6.00	6.16	6.32	6.49	7.06	7.24	7.42	8.01	8.22	8.41	8.56
Sun's Amp.	0 00	4.43	9.26	14.16	10.7	24.6	29.14	34.34	40.12	44.59	48.46

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.39	0.40	0.41	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.17	1.19	1.22	1.24	1.26	1.28	1.30	1.32	1.35	1.37	1.38
sw by s	1.58	2.01	2.04	2.07	2.10	2.14	2.17	2.21	2.24	2.27	2.29
s w	2.41	2.45	2.49	2.53	2.57	3.02	3.06	3.10	3.15	3.19	
sw by w	3.27	3.32	3.37	3.42	3.47	3.52	3.57				
w s w	4.16	4.21	4.27	4.33	4.38						
w by s	5.07	5.13	5.19								
West	6.00										
☉ set	6.00	5.44	5.28	5.11	4.54	4.36	4.18	3.59	3.38	3.19	3.04

A Sun-Dial for the Latitude of 59 Degrees.

North Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.38	0.37	0.36	0.35	0.34	0.32	0.31	0.30	0.29	0.29
s s w	1.18	1.16	1.14	1.12	1.10	1.08	1.05	1.04	1.01	1.10	0.58
sw by s	1.59	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.34	1.31	1.29
s w	2.42	2.38	2.35	2.31	2.27	2.23	2.19	2.14	2.10	2.06	2.03
sw by w	3.28	3.24	3.19	3.14	3.09	3.04	2.59	2.54	2.49	2.44	2.41
w s w	4.17	4.12	4.06	4.01	3.55	3.49	3.43	3.38	3.32	3.26	3.22
w by s	5.08	5.02	4.56	4.50	4.44	4.38	4.32	4.25	4.19	4.13	4.09
West	6.00	5.54	5.48	5.42	5.35	5.29	5.23	5.16	5.09	5.04	4.59
w by n				6.35	6.29	6.22	6.16	6.10	6.03	5.58	5.53
n w n						7.16	7.10	7.04	6.58	6.53	6.49
n w w								7.57	7.52	7.48	7.44
n w										8.42	8.38
☉ set	6.00	6.16	6.33	6.50	7.08	7.27	7.46	8.07	8.29	8.49	9.05
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampli	0.00	4.51	9.43	14.41	19.41	24.51	30.12	35.43	41.37	46.40	50.42

South Declination.

Deg.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Min.		30m		30m		30m		30m			29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.18	1.20	1.22	1.24	1.26	1.28	1.31	1.33	1.35	1.37	1.38
sw by s	1.59	2.02	2.05	2.08	2.11	2.14	2.18	2.21	2.24	2.27	2.29
s w	2.42	2.46	2.50	2.54	2.58	3.02	3.06	3.11	3.15		
sw by w	3.28	3.33	3.38	3.43	3.47	3.52	3.57				
w s w	5.17	4.22	4.28	4.33	4.39						
w by s	5.08	5.14	5.19								
West	6.00										
☉ set	6.00	5.44	5.27	5.10	4.56	4.33	4.12	3.53	3.31	3.11	2.55

A Sun-Dial for the Latitude of 60 Degrees.

North Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29
s s w	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	1.01	1.00
sw by s	2.00	1.57	1.54	1.51	1.48	1.45	1.42	1.39	1.36	1.33	1.31
s w	2.44	2.40	2.36	2.32	2.28	2.24	2.20	2.16	2.12	2.08	2.06
sw by w	3.29	3.25	3.20	3.16	3.11	3.06	3.01	2.56	2.51	2.47	2.44
w s w	4.18	4.13	4.07	4.02	3.57	3.51	3.46	3.40	3.34	3.29	3.25
w by s	5.08	5.03	4.57	4.51	4.45	4.40	4.34	4.27	4.21	4.16	4.12
West	6.00	5.54	5.48	5.42	5.36	5.31	5.24	5.18	5.11	5.06	5.02
w by n				6.35	6.29	6.23	6.17	6.11	6.04	5.59	5.55
w nw						7.16	7.10	7.04	6.59	6.54	6.50
nw by w								7.57	7.52	7.48	7.45
n w									8.41	8.39	8.39
☉ set	6.00	6.17	6.35	6.52	7.11	7.30	7.52	8.13	8.36	8.58	9.10
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0.00	5.00	10.2	15.8	20.18	25.39	31.0	36.58	43.10	48.32	52.51

South Declination.

Deg. Min.	0 d	2 d	5 d	7 d	10 d	12 d	15 d	17 d	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.38
sw by s	2.00	2.03	2.06	2.09	2.12	2.15	2.18	2.21	2.24	2.27	2.29
s w	2.44	2.47	2.51	2.55	2.59	3.03	3.07	3.11	3.15		
sw by w	3.29	3.34	3.39	3.43	3.48	3.53	3.58				
w s w	4.18	4.23	4.28	4.33	4.39						
w by s	5.08	5.14	5.20								
West	6.00										
☉ set	6.00	5.43	5.25	5.08	4.49	4.30	4.08	3.47	3.24	3.02	2.44

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The Description and Use of the foregoing Sun-Dial
T A B L E S.

THESE Tables are intituled at the head of each Page thus : *A Sun-Dial for the Latitude of 0 Degree* ; the next is, *A Sun-Dial for the Latitude of 1 Degree* ; and so on orderly unto 60 degrees, making in all 61 Dials ; from Page 24 to Page 84.

Each *Dial* hath two Tables (the uppermost for North Declination, the lowermost for South Declination) and 12 Columns in each Table : At the Head of each Column, and right against Deg. Min. are the degrees of Declination ; thus | 0d | 2d 30m | 5d | 7d 30m | 10d | 12d 30m | 15d | 17d. 30m | 20d | 22d | 23d. 29m. | ; d. standing for degree and m. for minute.

Under those degrees and minutes of Declination in each Column is set | h. m. | ; h. stands for Hour, and m. for Minute of an Hour.

In the Left hand Column of each Table, under Points, (at the head) are the Points of the Compass, thus, South ; S by W ; SSW ; SW by S ; SW ; &c. S by W. standing for South and by West ; SSW. for South South West ; SW by S. for South West by South, and so for the rest.

At the Foot of each Table, is the Sun's setting and Sun's Amplitude, agreeable to those several Declinations at the head of each Column ; and are distinguished from the rest by the Words in the Left-hand Column, thus, ☉ sets, Sun's Amplitude, or so much of them as the Column can contain. *Note*, The Sun's setting is annexed to each Table, but the Sun's Amplitude only to that for North Declination, because it's the same (for quantity) for South Declination.

The Sun's setting is Hours and Minutes, but the Amplitude is degrees and minutes, having (d) over the degrees, and (m) over the minutes.

By these Tables (being Sun-Dials for all Latitudes) may be known the Time of the Day, the Sun-being visible in any part of the Hemisphere, as true and exact as tho' he were upon the Meridian; also his Rising, Setting and Amplitude. The like may be known by any Star, whose Declination doth not exceed 23d. 29m. as will be evident by the following Propositions.

Proposition 1. **T**H E Latitude of a Place, the Sun's Declination, and his Bearing given; to find the Hour of the Day.

Note. By Bearing, is meant the Azimuth, or Point of the Compass he is upon; and that is found by Setting the Sun with an Azimuth Compass, which is the truest way, and is to be preferred before setting the Sun with a common Compass.

The Resolution of this Proposition is thus:

1. Seek in the *Sun-Dial Table* for the given Latitude.
2. At the Head of the Table seek the given Declination or the nearest to it.
3. Find the given Bearing, among the Points of the Compass in the Left-hand Column.
4. Then look straight to the Right-hand of the Bearing, till you come right under the Declination, (before found) in the head of the Table, and what Number you find there, is the Hour required.

Example 1. In the Latitude of 30 Degrees, the Sun having 15 degrees North Declination, I desire to know at what a Clock the Sun cometh upon the SW. Point of the Compass?

Look for the Table that belongeth to the Latitude of 30 degrees, in the head of the Table, which is in Page 54, and look for 15d. in the Column under North Declination, and for SW. on the Left-hand of the Table, and then in the common Angle of Meeting you'll find the Hour of the Day to be oh. 58m. that is 58m. past 12 a Clock, the Time required.

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Example 2. I desire to know at what a Clock the *Sun* cometh to the SW. in the Latitude of 30 degrees, the *Sun* having 15 degrees South Declination? *Answer*, 34 minutes past 2 a Clock.

For if you turn to the *Dial* for Latitude 30 degrees, in Page 54, and in the Table for South Declination, seek 15d. at the head of it, under which, and right against SW (on the Left hand) you'll find 2h. 34m. the time of the Day required.

If the Declination be not the same with the Declination in the Head of the Table; then look under that Declination nearest to the Declination proposed.

But more exactly thus, *Find the Hour for the next Declination both less and greater than the Declination proposed*, and take the Difference of those Hours, as also of the Declinations belonging to them: then say,

As the last difference, is to the first difference; so is the difference between the Declination proposed and the next less in the Table, to a fourth Proportional, which add to (*when the Hour in the Table increaseth*) or (*when it decreaseth*) subtract from the Hour belonging to the less Declination aforesaid: So you'll have the Hour required exact to the Declination proposed.

Example 3. Admit the Declination to be 18 deg. 20m. North, I desire to know at what a Clock the *Sun* cometh upon the WSW. Point of the Compass, in the Latitude of 30 degrees?

In the Table, the nearest Number to 18 deg. 20m is 17d. 30m. Then under 17d. 30m. and against WSW. is 1h. 42m. which sheweth that the *Sun* cometh upon the WSW. Point of the Compass, at 42 min. past one a Clock.

Now because the Declination proposed, and the Declination in the Head of the Table, are somewhat differing; therefore you may make a Proportion, very easily, thus, under 17d. 30m. and against W S W. you'll find

1h. 42m. and under 2od. 00m. you'll find 1h. 25m. And the difference between these two Numbers is 17m. And the difference between the Declination 17d. 30m. And 2od. is 2d. 30m. or 150m. Also the difference between the Declination 18d. 20m. and 17d. 30m. is 50m. Then say, As 150m. is to 17m. so is 50m. to 6m. almost: But because 50 is $\frac{1}{3}$ of 150, therefore the third part of 17m. is near 6m. which subtracted from 1h. 42m. (because the Hour decreaseth) and the Remainder 1h. 36m. is the true Hour of the Day, the Sun being upon the WSW. point of the Compass, having 18 deg. 20 min. North Declination.

Do the like with any other Degrees and and Minutes of Declination: But if the Declination be not much differing from that in the Head of the Table, you need not make any Proportion: Likewise when the Sun is near the Meridian, you need not make any Proportion, because there the difference is but small.

Note, There are none but the *Afternoon Points* in the Tables of these *Dials*, yet you may easily find the Time of the Day for the *Forenoon Points* by what follows.

For Points equally distant from the Meridian, are equal Time from Noon, so that at what space of Time from Noon the Sun is SE. in the Forenoon, the like space of Time from Noon he is SW. Afternoon.

As in the *Table* following, the Points that stand right against one another, are equally distant from the Meridian; therefore to find the Hour of the Day, the Sun being upon any of the Forenoon Points, see what Time of the Day it is when the Sun is upon the Afternoon Points that stand right against the Forenoon Points desired, and subtract those Hours and Minutes from 12 Hours, the Remainder is the Hour and Minute of the Day required.

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A TABLE of the Points of the Compass, equally distant from the Meridian.

Forenoon Points.	Afternoon Points.
South <i>South by East</i> <i>South South East</i> <i>South East by South</i> <i>South East</i> <i>South East by East</i> <i>East South East</i> <i>East by South</i> East	South <i>South by West</i> <i>South South West</i> <i>South West by South</i> <i>South West</i> <i>South West by West</i> <i>West South West</i> <i>West by South</i> West
<i>East by North</i> <i>East North East</i> <i>North East by East</i> <i>North East</i> <i>North East by North</i> <i>North North East</i> <i>North by East</i> North	<i>West by North</i> <i>West North West</i> <i>North West by West</i> <i>North West</i> <i>North West by North</i> <i>North North West</i> <i>North by West</i> North
Forenoon Points.	Afternoon Points.

Example 4. In the Latitude of 60 degrees, the Sun being North East ; I demand the Hour of the Day, the Sun having 22 degrees North Declination ?

In the *Sun-Dial* for Latitude 60 degree, (in Page 84) lock against NW. (which is the *Afternoon Point*, corresponding to NE. the *Forenoon Point*,) and finding the Declination 22 degrees in the Head of the Table, in the common Angle of meeting is 8 Hours 41 Minutes, which subtract from 12 Hours, the Remainder 3 Hours 19 Minutes

The Mariner's Compass Rectified.

Minutes is the Hour of the Day desired, in the Morning.

Example 5. The Sun being E.N.E. in the same Latitude, with the same Declination; I demand the Hour of the Day?

In Latitude 60 deg. and North Declination 22 degrees, the Sun being WNW. it is 45 minutes past 6 a Clock in the Afternoon; which subtract from 12 Hours, the Remainder is 6 minutes past 5 in the Morning; the Time desired.

Example 6. In the Latitude of 35 degrees North, the Sun having 15 degrees North Declination, and being South East by East; I demand the Hour and Minute of the Day?

In the Table for Latitude 35 degrees (in Page 59) look against S.W. by W. (the Afternoon Point correspondent to S.E. by E. the Forenoon Point,) And the Declination 15d. in the Head of the Table, and in the common Angle of meeting is 1h. 45m. which deducted from 12 Hours, the remainder is 15 minutes past 10 a Clock, the true Time of the Day desired.

Example 7. In the Latitude of 35 degrees North, the Sun having 15 degrees South Declination, and being S.E. by E. I demand the Hour of the Day?

Ans. 20 Minutes past 8 a Clock; for the Hour in the Table is 3 Hours, 40 Minutes, which subtracted from 12 Hours, leaveth 8 Hours 20 Minutes, the Hour required.

The like is to be understood of any other Latitude, with any other Declination, and with any other Point of the Compass.

Note; These Tables serve as well in *South Latitude*, as in *North Latitude*, only the difference will be this:

If the Latitude be contrary, then the Declination must be contrary, and the Points of the *Compass* contrary; that is to say, North Declination must be counted South; and South Declination must be counted North; and the South point

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Point must be North; and S. by W. must be N. by W. and S S W. must be N N W. and S W by S. must be N W. by N. and so for any other Point, as in the following Table.

A *TABLE* of Points equally distant from Noon both in North Latitude, and in South Latitude; either before Noon or Afternoon.

North Latitude.		South Latitude.	
Forenoon.	Afternoon.	Forenoon.	Afternoon.
S by E	S by W	N by E	N by W
S S E	S S W	N N E	N N W
S E by S	S W by S	N E by N	N W by N
South East	South West	North East	North West
S E by E	S W by W	N E by E	N W by W
E S E	W S W	E N E	W N W
E by S	W by S	E by N	W by N
East	West	East	West
E by N	W by N	E by S	W by S
E N E	W N W	E S E	W S W
N E by E	N W by W	S E by E	S W by W
North East	North West	South East	South West
N E by N	N W by N	S E by S	S W by S
N N E	NNW	S S E	S S W
N by E	N by W	S by E	S by W
North	North	South	South

Proposition 2. To find the Hour of the Night by the Stars, and the Tables of the Sun Dial.

YOU may find the Hour of the Night, by the Bearing of any known Star, whose Declination doth not exceed the Sun's greatest Declination; after this manner.

Find the Time of the *Star's* coming to the Meridian on the

the Day proposed; then if the Star be on the East side of the Meridian, subtract the Hours and Minutes which these Tables shew, from the Time of the Star's coming to the Meridian, the Remainder is the Hour of the Night. But if the Star be on the West-side of the Meridian, then add those Hours and Minutes abovesaid, to the Time of the Star's coming to the Meridian, the Sum is the Hour of the Night.

To find what time the Stars come upon, or to the Meridian, see the *Mariner's Kalendar*, in the Uses of the Tables of the Sun's, and a Star's Right Ascension, Pages 57, 58, 59, 60, and 61.

Example 8. Admit the 6th Day of *October*, in the Latitude 40 degrees North, I observe the *Bull's Eye* to be NE. I demand the Hour of the Night?

The 6th Day of *October*, the *Bull's Eye* cometh on the Meridian at 51 Minutes past 2 a Clock in the Morning; this *Star's* Declination is 15 deg. 56 min. N. therefore in the Table that belongs to 40 degrees in Page 64, seek in the Head of the Table the Declination of the *Star*, and by the side, the Point of the Compass, and in the common Angle of meeting, is 1 hour 31m. which subtract from 2 hours 51m. the *Star's* Southing, the Remainder 1 hour 20 min. is the Hour of the Night desired. But if this *Star* had born S. W. you must have added, and then the Hour would have been 22 min. past 4 a Clock in the Morning.

The Operation.

	h.	m.
The Time of the <i>Star's</i> being on the Meridian	2	: 51
His Distance from the Mer. either at SE. or SW.	1	: 31
The Time of the Night, the <i>Star</i> being SE.	—	1 : 20
The Time of the Night, the <i>Star</i> being SW.	—	4 : 22

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Example 9. Admit the 5th Day of November, in Latitude 45 degrees North; I see the *Lion's Tail* upon the ESE. point of the Compass, having Declination 16d. 6m. North, I demand the Hour of the Night?

The Operation. h. m.

Time of the Stars being on the Meridian—08 : 07Morn.

His Distance from the Meridian, being ————03 : 01

Time of the Night, the Star is E.S.E. ————05 : 06Morn.

Time when this Star is W.S.W. ————11 : 08Morn.

Note, If the Compass hath Variation, you must allow for the Variation: But if you will use this following Instrument, I call a Rectifier, you need nor reckon which way the Variation is, either Eastward or Westward; for this Instrument will do it so plain, that you cannot be mistaken, as is shewn in the following part of this Book: But for the present I will only give you one Proposition, and apply it upon the Rectifier, which is as followeth.

Admit in Latitude 47 degrees North, the Sun being in one of the Equinoctial Points, at which time he hath no Declination, I observe the Sun to rise upon the ESE. Point of the Compass; I demand the Variation?

The Sun having no Declination, in any Latitude (if there be no Variation) the Sun will rise at East, and set at West; but according to the foregoing Proposition, the Sun did rise at E.S.E. therefore there is two Points Variation, as will appear by the following Rectifier.

The Description of the Rectifier.

THIS Instrument containeth two *Circles* or *Compasses*, one within the other; but as it is made in Wood, the one moveth upon the other; so that the inward or upper

upper Circle, representeth the Compass that you steer by, which is subject to Variation; but the outward or under Circle, representeth a true Compass that never varieth. And by it you may readily rectify your Compass, when it doth vary; thus:

Always bring the true Point of Rising, or Setting on the outward or under Compass, to touch the false Point of Rising, or Setting, on the inward or upper Compass, there let the Instrument stand.

As in this foregoing Proposition: The East Point is the true Point of Rising, and the ESE. Point is the false Point of Rising, therefore bring the East Point on the outward or under Compass, to touch the ESE. Point on the inward or upper Compass.

Then the Points that are upon the outward Compass, do explain the Points that are upon the inward Compass; so that according to this Observation the NNE. Point on your Compass, is the True North Point; and the North is the true NNW. and the NW. is the True WNW. and the West is the True WSW. Point; as plainly appears by the Rectifier.

Note, The True Points are always counted on the outward Circle or Compass.

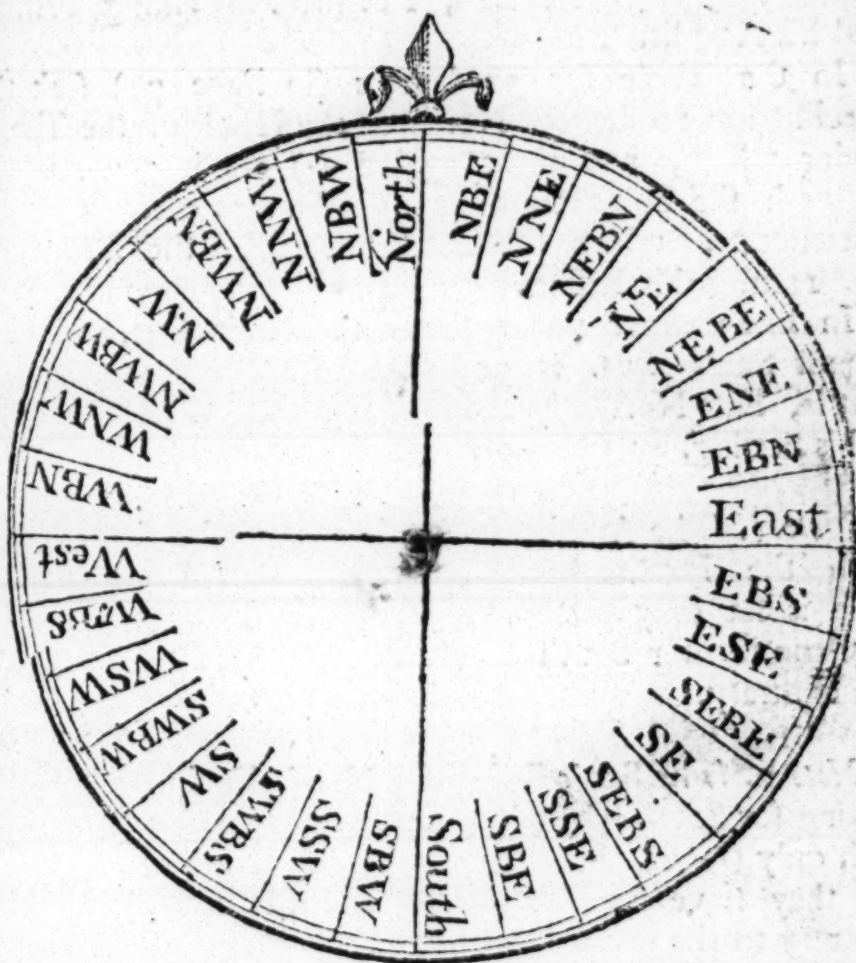
This Instrument in Wood, is larger than this Figure, and there the Points are divided into Halves and Quarters; as also each Compass (in some) is divided into 360 degrees, numbred from the North, and South, (both ways) towards the East and West, ending there in 90 degrees.



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Proposition 3. *To find the Sun's Rising, Setting, or Amplitude by the Table of the Sun-Dial.*

IN the Table for the Latitude of the Place, seek the Declination, under which, and against $\odot$ Set, is the Sun's Setting ; and against *Sun's Amp.* is the Amplitude.

And

And if you subtract the Sun's Setting from 12 Hours, it gives his Rising.

Example 10. Latitude 50 degrees North, Sun's Declination 20 degrees North, I demand his Rising, Setting, and his Amplitude?

In the Table for 50 degrees (in Page 74) seek the Declination 20 degrees North at the Head of the Table, under which, and right against $\odot$ set is 7.43, which sheweth the Sun setteth at 43 Minutes after 7 in the Afternoon; which subtract from 12h. the Remainder 4h. 17m. is his Rising.

In like manner under the Sun's Declination 20d. and against Sun's *Amp.* is 32d. 8m. the Sun's Amplitude: that is, East Northerly at his Rising, but West Northerly at his Setting.

Note 1. The Amplitude is always of the same Name with the Declination: For that Reason the Amplitude is set only for North Declination, being the same in Quantity for South Declination, only in Quality it's the contrary.

Note 2. The Sun's Rising for North Declination, is the Setting for South Declination: For that Reason the Table hath only $\odot$ set, both for North and South Declination; yet they serve for both Rising and Setting, by looking contrary to the given Declination.

Wherefore, to find the Sun's Rising, when he hath North Declination, look under South Declination; and when he hath South Declination, (to find his Rising) look under North Declination.

Note 3. In South Latitude with South Declination, also in South Latitude with North Declination, the Sun's Rising and Setting is the same as in North Latitude with North Declination, as also in North Latitude with South Declination.

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Therefore these Tables are as useful in South Latitude, as in North Latitude; if North Declination in these Tables be counted for South, and South for North.

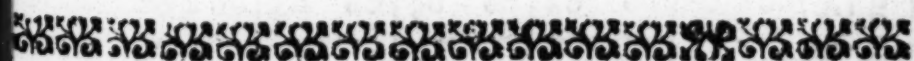
Note 4. The Rising, Setting, and Amplitude of any Star (whose Declination doth not exceed the Sun's greatest Declination) may be found by these Tables; provided its Southing, or Time of the Star's coming to or on the Meridian, be known.

For the Time of Sun-setting in these Tables for any Latitude, is a Star's half Continuance above the Horizon, having equal Declination, and the same kind with the Sun, for the same Latitude.

Therefore the half Continuance of a Star above the Horizon (found in these Tables as before directed) added to, and subtracted from the Star's coming to, or on the Meridian; the first is the Star's Setting, the latter its Rising.

Examples of this Nature you will find in the Use of the next Tables of Semidiurnal and Seminocturnal Arches, to which the Reader is referred.

The Amplitude of a Star by the foregoing Tables is found as the Amplitude of the Sun was, which is more fully treated on in the Use of the Tables of Amplitude, in *Page 146*.



Astronomic TABLES of Semidiurnal and Seminocturnal Arches: Shewing the True Time of the SUN's Rising and Setting; with the Length of the Day and Night, for any Day in the Year; fitting all Places in the World, whose Pole is not elevated above 60 Degrees, either North or South; and to last with Exactness, as long as God upholdeth the Course of Nature.

A Table shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude,

Sun's Declin.	1		2		3		4		5		6	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	00	06	00	06	00	06	00	06	00	06	00
2	06	00	06	00	06	00	06	00	06	01	06	01
3	06	00	06	00	06	01	06	01	06	01	06	01
4	06	00	06	00	06	01	06	01	06	01	06	02
5	06	00	06	00	06	01	06	01	06	02	06	02
6	06	00	06	01	06	01	06	02	06	02	06	03
7	06	00	06	01	06	01	06	02	06	02	06	03
8	06	00	06	01	06	02	06	02	06	03	06	03
9	06	01	06	01	06	02	06	03	06	03	06	04
10	06	01	06	01	06	02	06	03	06	04	06	04
11	06	01	06	01	06	02	06	03	06	04	06	05
12	06	01	06	02	06	02	06	03	06	04	06	05
13	06	01	06	02	06	03	06	04	06	05	06	06
14	06	01	06	02	06	03	06	04	06	05	06	06
15	06	01	06	02	06	03	06	04	06	05	06	06
16	06	01	06	02	06	03	06	05	06	06	06	07
17	06	01	06	02	06	04	06	05	06	06	06	07
18	06	01	06	03	06	04	06	05	06	07	06	08
19	06	01	06	03	06	04	06	05	06	07	06	08
20	06	01	06	03	06	04	06	06	06	07	06	09
21	06	02	06	03	06	05	06	06	06	08	06	09
22	06	02	06	03	06	05	06	06	06	08	06	10
23	06	02	06	03	06	05	06	07	06	09	06	10
23, 29	06	02	06	04	06	05	06	07	06	09	06	11

Degrees of Declination.

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Degrees of Declination.

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A Table shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	7		8		9		10		11		12	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	00	6	00	6	00	6	00	6	00	6	00
1	6	00	6	00	6	01	6	01	6	01	6	01
2	6	01	6	01	6	01	6	01	6	02	6	02
3	6	01	6	02	6	02	6	02	6	02	6	03
4	6	02	6	02	6	02	6	03	6	03	6	03
5	6	02	6	03	6	03	6	04	6	04	6	04
6	6	03	6	03	6	04	6	04	6	05	6	05
7	6	03	6	04	6	04	6	05	6	05	6	06
8	6	04	6	04	6	05	6	06	6	06	6	07
9	6	04	6	05	6	06	6	06	6	07	6	08
10	6	05	6	06	6	06	6	07	6	08	6	09
11	6	05	6	06	6	07	6	08	6	09	6	09
12	6	06	6	07	6	08	6	09	6	09	6	10
13	6	06	6	07	6	08	6	09	6	10	6	11
14	6	07	6	08	6	09	6	10	6	11	6	12
15	6	08	6	09	6	10	6	11	6	12	6	13
16	6	08	6	09	6	10	6	12	6	13	6	14
17	6	09	6	10	6	11	6	12	6	14	6	15
18	6	09	6	10	6	12	6	13	6	14	6	16
19	6	10	6	11	6	13	6	14	6	15	6	17
20	6	10	6	12	6	14	6	15	6	16	6	18
21	6	11	6	12	6	14	6	16	6	17	6	19
22	6	11	6	13	6	15	6	16	6	18	6	20
23	6	12	6	14	6	15	6	17	6	19	6	21
23,29	6	12	6	14	6	16	6	17	6	19	6	21

A Table shewing the Semidiurnal Arch, or Time of Sun setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	13		14		15		16		17		18	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	00	6	00	6	00	6	00	6	00	6	00
1	6	01	6	01	6	01	6	01	6	01	6	01
2	6	02	6	02	6	02	6	02	6	02	6	02
3	6	03	6	03	6	03	6	03	6	04	6	04
4	6	04	6	04	6	04	6	05	6	05	6	05
5	6	05	6	05	6	05	6	06	6	06	6	06
6	6	06	6	06	6	06	6	07	6	07	6	08
7	6	06	6	07	6	07	6	08	6	09	6	09
8	6	07	6	08	6	09	6	09	6	10	6	10
9	6	08	6	09	6	10	6	10	6	11	6	12
10	6	09	6	10	6	11	6	12	6	12	6	13
11	6	10	6	11	6	12	6	13	6	13	6	14
12	6	11	6	12	6	13	6	14	6	15	6	16
13	6	12	6	13	6	14	6	15	6	16	6	17
14	6	13	6	14	6	15	6	16	6	17	6	19
15	6	14	6	15	6	16	6	18	6	19	6	20
16	6	15	6	16	6	18	6	19	6	20	6	21
17	6	16	6	17	6	19	6	20	6	21	6	22
18	6	17	6	19	6	20	6	21	6	23	6	24
19	6	18	6	20	6	21	6	23	6	24	6	26
20	6	19	6	21	6	22	6	24	6	25	6	27
21	6	20	6	22	6	24	6	25	6	27	6	29
22	6	21	6	23	6	25	6	27	6	28	6	30
23	6	22	6	24	6	26	6	28	6	30	6	32
23, 29	6	23	6	25	6	27	6	29	6	31	6	33

A Table when Arch climat

Sun's Declin.

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Degrees of Declination.

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A Table shewing the Semidiurnal Arch, or Time of Sun setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	19		20		21		22		23		24	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	01	06	01	06	01	06	02	06	02	06	02
2	06	03	06	03	06	03	06	03	06	03	06	03
3	06	04	06	04	06	05	06	05	06	05	06	05
4	06	05	06	06	06	06	06	06	06	07	06	07
5	06	07	06	07	06	08	06	08	06	09	06	09
6	06	08	06	09	06	09	06	10	06	10	06	11
7	06	10	06	10	06	11	06	11	06	12	06	13
8	06	11	06	12	06	12	06	13	06	14	06	14
9	06	13	06	13	06	14	06	15	06	15	06	16
10	06	14	06	15	06	16	06	16	06	17	06	18
11	06	15	06	16	06	17	06	18	06	19	06	20
12	06	17	06	18	06	19	06	20	06	21	06	22
13	06	18	06	19	06	20	06	21	06	23	06	24
14	06	20	06	21	06	22	06	23	06	24	06	25
15	06	21	06	22	06	24	06	25	06	26	06	27
16	06	23	06	24	06	25	06	27	06	28	06	29
17	06	24	06	25	06	27	06	28	06	30	06	31
18	06	26	06	27	06	29	06	30	06	32	06	33
19	06	27	06	29	06	30	06	32	06	34	06	35
20	06	28	06	30	06	32	06	34	06	36	06	37
21	06	30	06	32	06	34	06	36	06	37	06	39
22	06	31	06	33	06	35	06	37	06	39	06	41
23	06	33	06	35	06	37	06	39	06	41	06	43
23, 29	06	34	06	36	06	38	06	40	06	42	06	44

A Table shewing the Semidurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	25		26		27		28		29		30	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	02	06	02	06	02	06	02	06	02	06	02
2	06	04	06	04	06	04	06	04	06	04	06	05
3	06	06	06	06	06	06	06	06	06	07	06	07
4	06	07	06	08	06	08	06	09	06	09	06	09
5	06	09	06	10	06	10	06	11	06	11	06	12
6	06	11	06	12	06	12	06	13	06	13	06	14
7	06	13	06	14	06	14	06	15	06	16	06	16
8	06	15	06	16	06	16	06	17	06	18	06	19
9	06	17	06	18	06	19	06	19	06	20	06	21
10	06	19	06	20	06	21	06	22	06	23	06	23
11	06	21	06	22	06	23	06	24	06	25	06	26
12	06	23	06	24	06	25	06	26	06	27	06	28
13	06	25	06	26	06	27	06	28	06	29	06	31
14	06	27	06	28	06	29	06	30	06	32	06	33
15	06	29	06	30	06	31	06	33	06	34	06	36
16	06	31	06	32	06	34	06	35	06	37	06	38
17	06	33	06	34	06	36	06	37	06	39	06	41
18	06	35	06	36	06	38	06	40	06	42	06	43
19	06	37	06	39	06	40	06	42	06	44	06	46
20	06	39	06	41	06	43	06	45	06	47	06	48
21	06	41	06	43	06	45	06	47	06	49	06	51
22	06	43	06	45	06	48	06	50	06	52	06	54
23	06	46	06	48	06	50	06	52	06	54	06	57
23, 29	06	47	06	49	06	51	06	53	06	55	06	58

Degrees of Declination.

A Table when Arch, Declin

Sun's Declin

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Degrees of Declination.

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A Table shewing the Semidiurnal Arch, or the Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude

Sun's Declin	31		32		33		34		35		36	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	02	06	02	06	03	06	03	06	03	06	03
2	06	05	06	05	06	05	06	05	06	06	06	06
3	06	07	06	08	06	08	06	08	06	08	06	09
4	06	10	06	10	06	10	06	11	06	11	06	12
5	06	12	06	13	06	13	06	14	06	14	06	15
6	06	15	06	15	06	16	06	16	06	17	06	18
7	06	17	06	18	06	18	06	19	06	20	06	20
8	06	19	06	20	06	21	06	22	06	23	06	23
9	06	22	06	23	06	24	06	25	06	25	06	26
10	06	24	06	25	06	26	06	27	06	28	06	29
11	06	27	06	28	06	29	06	30	06	31	06	32
12	06	29	06	31	06	32	06	33	06	34	06	36
13	06	32	06	33	06	34	06	36	06	37	06	39
14	06	34	06	36	06	37	06	39	06	40	06	42
15	06	37	06	39	06	40	06	42	06	43	06	45
16	06	40	06	41	06	43	06	45	06	46	06	48
17	06	42	06	44	06	46	06	48	06	49	06	51
18	06	45	06	47	06	49	06	51	06	53	06	55
19	06	48	06	50	06	52	06	54	06	56	06	58
20	06	51	06	53	06	55	06	57	06	59	07	01
21	06	53	06	56	06	58	07	00	07	02	07	05
22	06	56	06	58	07	01	07	03	07	06	07	08
23	06	59	07	01	07	04	07	06	07	09	07	12
23,29	07	01	07	03	07	06	07	08	07	11	07	14

A Table shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude

Sun's Declin.	37		38		39		40		41		42	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	03	06	03	06	03	06	03	06	03	06	03
2	06	06	06	06	06	06	06	07	06	07	06	07
3	06	09	06	09	06	10	06	10	06	10	06	11
4	06	12	06	13	06	13	06	13	06	14	06	14
5	06	15	06	16	06	16	06	17	06	17	06	18
6	06	18	06	19	06	20	06	20	06	21	06	22
7	06	21	06	22	06	23	06	24	06	25	06	25
8	06	24	06	25	06	26	06	27	06	28	06	29
9	06	27	06	28	06	29	06	31	06	32	06	33
10	06	31	06	32	06	32	06	34	06	35	06	37
11	06	34	06	35	06	36	06	38	06	39	06	40
12	06	37	06	38	06	40	06	41	06	43	06	44
13	06	40	06	42	06	43	06	45	06	46	06	48
14	06	43	06	45	06	47	06	48	06	50	06	52
15	06	47	06	48	06	50	06	52	06	54	06	56
16	06	50	06	52	06	54	06	56	06	58	07	00
17	06	53	06	55	06	57	07	00	07	02	07	04
18	06	57	06	59	07	01	07	03	07	06	07	08
19	07	00	07	02	07	05	07	07	07	10	07	12
20	07	04	07	06	07	09	07	11	07	14	07	17
21	07	07	07	10	07	12	07	15	07	18	07	21
22	07	11	07	14	07	16	07	19	07	22	07	25
23	07	15	07	17	07	20	07	23	07	27	07	30
23, 29	07	17	07	19	07	22	07	25	07	29	07	32

Degrees of Declination.

A Table shewing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

Sun's Declin.												
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	03	06	03	06	03	06	03	06	03	06	03
2	06	06	06	06	06	06	06	07	06	07	06	07
3	06	09	06	09	06	10	06	10	06	10	06	11
4	06	12	06	13	06	13	06	13	06	14	06	14
5	06	15	06	16	06	16	06	17	06	17	06	18
6	06	18	06	19	06	20	06	20	06	21	06	22
7	06	21	06	22	06	23	06	24	06	25	06	25
8	06	24	06	25	06	26	06	27	06	28	06	29
9	06	27	06	28	06	29	06	31	06	32	06	33
10	06	31	06	32	06	32	06	34	06	35	06	37
11	06	34	06	35	06	36	06	38	06	39	06	40
12	06	37	06	38	06	40	06	41	06	43	06	44
13	06	40	06	42	06	43	06	45	06	46	06	48
14	06	43	06	45	06	47	06	48	06	50	06	52
15	06	47	06	48	06	50	06	52	06	54	06	56
16	06	50	06	52	06	54	06	56	06	58	07	00
17	06	53	06	55	06	57	07	00	07	02	07	04
18	06	57	06	59	07	01	07	03	07	06	07	08
19	07	00	07	02	07	05	07	07	07	10	07	12
20	07	04	07	06	07	09	07	11	07	14	07	17
21	07	07	07	10	07	12	07	15	07	18	07	21
22	07	11	07	14	07	16	07	19	07	22	07	25
23	07	15	07	17	07	20	07	23	07	27	07	30
23, 29	07	17	07	19	07	22	07	25	07	29	07	32

Degrees of Declination.

A Table shewing the Semidiurnal Arch, or Time of Sun setting when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	43		44		45		46		47		48	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	04	06	04	06	04	06	04	06	04	06	04
2	06	07	06	08	06	08	06	08	06	09	06	09
3	06	11	06	12	06	12	06	12	06	13	06	13
4	06	15	06	15	06	16	06	17	06	17	06	18
5	06	19	06	19	06	20	06	21	06	22	06	22
6	06	22	06	23	06	24	06	25	06	26	06	27
7	06	26	06	27	06	28	06	29	06	30	06	31
8	06	30	06	31	06	32	06	33	06	35	06	36
9	06	34	06	35	06	36	06	38	06	39	06	41
10	06	38	06	39	06	41	06	42	06	43	06	45
11	06	42	06	43	06	45	06	46	06	48	06	50
12	06	46	06	47	06	49	06	51	06	53	06	55
13	06	50	06	52	06	53	06	55	06	57	06	59
14	06	54	06	56	06	58	07	00	07	02	07	04
15	06	58	07	00	07	02	07	04	07	07	07	09
16	07	02	07	04	07	07	07	09	07	12	07	14
17	07	06	07	09	07	11	07	14	07	17	07	19
18	07	11	07	13	07	16	07	19	07	22	07	25
19	07	15	07	18	07	21	07	24	07	27	07	30
20	07	19	07	22	07	25	07	29	07	32	07	35
21	07	24	07	27	07	30	07	34	07	37	07	41
22	07	28	07	31	07	35	07	39	07	43	07	47
23	07	33	07	37	07	40	07	44	07	48	07	53
24	07	36	07	39	07	43	07	47	07	51	07	56

Degrees of Declination.

A Table shewing the Semidiurnal Arch, or Time of Sun setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	49		50		51		52		53		54	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	05	06	05	06	05	06	05	06	05	06	06
2	06	09	06	10	06	10	06	10	06	11	06	11
3	06	14	06	14	06	15	06	15	06	16	06	17
4	06	18	06	19	06	20	06	21	06	21	06	22
5	06	23	06	24	06	25	06	26	06	27	06	28
6	06	28	06	29	06	30	06	31	06	32	06	33
7	06	32	06	34	06	35	06	36	06	38	06	39
8	06	37	06	39	06	40	06	41	06	43	06	45
9	06	42	06	44	06	45	06	47	06	49	06	50
10	06	47	06	49	06	50	06	52	06	54	06	56
11	06	52	06	54	06	56	06	58	07	00	07	02
12	06	57	06	59	07	01	07	03	07	06	07	08
13	07	02	07	04	07	06	07	09	07	11	07	14
14	07	07	07	09	07	12	07	14	07	17	07	20
15	07	12	07	14	07	17	07	20	07	23	07	27
16	07	17	07	20	07	23	07	26	07	29	07	33
17	07	22	07	25	07	29	07	32	07	36	07	40
18	07	28	07	31	07	35	07	38	07	42	07	46
19	07	33	07	37	07	41	07	45	07	49	07	53
20	07	39	07	43	07	47	07	51	07	56	08	00
21	07	45	07	49	07	53	07	58	08	02	08	08
22	07	51	07	55	08	00	08	05	08	10	08	15
23	07	57	08	02	08	06	08	12	08	17	08	23
23, 20	08	00	08	05	08	10	08	16	08	21	08	27

Degrees of Declination.

A Table shewing the Semidiurnal Arch, or Time of Sun setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

Sun's Declin.	55	
	H	M
0	06	00
1	06	05
2	06	09
3	06	14
4	06	18
5	06	23
6	06	28
7	06	32
8	06	37
9	06	42
10	06	47
11	07	02
12	07	06
13	07	11
14	07	17
15	07	23
16	07	29
17	07	36
18	07	42
19	07	49
20	08	00
21	08	08
22	08	15
23	08	23
23, 20	08	27

Degrees of Declination.

A Table showing the Semidiurnal Arch, or Time of Sun-setting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-rising, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Declin.	55		56		57		58		59		60	
	H	M	H	M	H	M	H	M	H	M	H	M
0	06	00	06	00	06	00	06	00	06	00	06	00
1	06	06	06	06	06	06	06	06	06	07	06	07
2	06	11	06	12	06	12	06	13	06	13	06	14
3	06	17	06	18	06	19	06	19	06	20	06	21
4	06	23	06	24	06	25	06	26	06	27	06	28
5	06	29	06	30	06	31	06	32	06	33	06	35
6	06	35	06	36	06	37	06	39	06	40	06	42
7	06	40	06	42	06	44	06	45	06	47	06	49
8	06	46	06	48	06	50	06	52	06	54	06	56
9	06	52	06	54	06	56	06	59	07	01	07	04
10	06	58	07	00	07	03	07	06	07	08	07	11
11	07	04	07	07	07	10	07	13	07	16	07	19
12	07	11	07	13	07	16	07	20	07	23	07	26
13	07	17	07	20	07	23	07	27	07	30	07	34
14	07	23	07	27	07	30	07	34	07	38	07	42
15	07	30	07	34	07	38	07	42	07	46	07	51
16	07	37	07	41	07	45	07	49	07	54	07	59
17	07	44	07	48	07	52	07	57	08	03	08	08
18	07	51	07	55	08	00	08	05	08	11	08	17
19	07	58	08	03	08	08	08	14	08	20	08	26
20	08	05	08	10	08	16	08	22	08	29	08	36
21	08	13	08	19	08	25	08	32	08	39	08	47
22	08	21	08	27	08	34	08	41	08	49	08	58
23	08	29	08	36	08	43	08	51	09	00	09	09
23, 29	08	33	08	41	08	48	08	56	09	05	09	15

The Use of the foregoing TABLES, of
Semidiurnal and Seminocturnal Arches.

To find the Time of the Sun's Rising and Setting, and
the Length of the Day, and of the Night by these
Tables.

FIRST, seek the Sun's Declination, in the Tables
of Declination, for the Day proposed; with which
enter the Table of Semidiurnal and Seminocturnal
Arches; finding the Latitude of the Place in the Head
of this Table, and the Degree of the Sun's Declination
in the first Column on the Left-hand; and in the com-
mon Angle of Meeting is the Semidiurnal Arch, if the
Sun hath North Declination; but it's the Seminocturnal
Arch, if the Sun hath South Declination.

Example 1. For Illustration hereof, let it be required
to find the Time of the Sun's Rising, Setting, and the
Length of the Day, and Length of the Night for the 23^d
Day of *April*, 1745. in Latitude 46 Degrees North?

At which Time the Sun's Declination is 16 deg. 4 min.
North; with which enter the Table, as is before de-
clared, and the Semidiurnal Arch is 7 Hours, 9 Min. the
true Time of Sun-setting; whose Complement to 12
Hours is the Seminocturnal Arch, or the Time of Sun-
rising, and is 4 Hours 51 Min. Double the Semidiurnal
Arch, you have the Length of the Day; double the Se-
minocturnal Arch, the Aggregate is the Length of the
Night. See the Work following.

H. M.

12 : 00

The Semidiurnal Arch, or Time of Sun setting— 07 : 09

The Complement to 12 Hours is ———— 04 : 51

The Seminocturnal Arch, or Time of Sun-rising, in
Latitude 46 Degrees North, is 4 Hours 51 Minutes. The

H. M.

The Semidiurnal Arch doubled ————— { 07 : 09
 The Length of the Day, *April 23, 1745.* is ——— 07 : 09
 The Seminocturnal Arch doubled ————— { 04 : 51
 The Length of the Night, *April 23, 1745.* is ——— 04 : 51
 ————— 09 : 42
 —————

Example 2. But when the Sun hath 16 deg. 04 min. South Declination, in this Latitude of 46 deg. North; then the Day-Arch will become the Night-Arch, and the Night-Arch will become the Day-Arch.

As, on *October 26, 1745*, the Sun hath 16 deg. 07 min. South Declination; then the Time of the Sun's Rising is 7 Hours 10 Minutes, his Setting 4 Hours 50 Minutes; the Length of the Day 9 Hours 40 Minutes, and the Length of the Night 14 Hours 20 Minutes.

Example 3. Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 15th of *December, 1745*, in Latitude 53 deg. North; at which Time the Sun's Declination is 23 deg. 24 min. South?

H. M.

12 : 00

The Seminocturnal Arch, or Time of Sun-rising 08 : 21

The Complement to 12 Hours is ————— 03 : 39

And is the Semidiurnal Arch, or Time of Sun-setting.

The Semidiurnal Arch doubled ————— { 03 : 39
 ————— 03 : 39

The Length of the Day, *December 15, 1745,* 07 : 18

The Seminocturnal Arch doubled ————— { 08 : 21
 ————— 08 : 21

The Length of the Night, *December 15, 1745,* is 16 : 42

These

The Use of the foregoing TABLES, of
Semidiurnal and Seminocturnal Arches.

To find the Time of the Sun's Rising and Setting, and the Length of the Day, and of the Night by these Tables.

FIRST, seek the Sun's Declination, in the Tables of Declination, for the Day proposed; with which enter the Table of Semidiurnal and Seminocturnal Arches; finding the Latitude of the Place in the Head of this Table, and the Degree of the Sun's Declination in the first Column on the Left-hand; and in the common Angle of Meeting is the Semidiurnal Arch, if the Sun hath North Declination; but it's the Seminocturnal Arch, if the Sun hath South Declination.

Example 1. For Illustration hereof, let it be required to find the Time of the Sun's Rising, Setting, and the Length of the Day, and Length of the Night for the 23^d Day of April, 1745. in Latitude 46 Degrees North?

At which Time the Sun's Declination is 16 deg. 4 min. North; with which enter the Table, as is before declared, and the Semidiurnal Arch is 7 Hours, 9 Min. the true Time of Sun-setting; whose Complement to 12 Hours is the Seminocturnal Arch, or the Time of Sun-rising, and is 4 Hours 51 Min. Double the Semidiurnal Arch, you have the Length of the Day; double the Seminocturnal Arch, the Aggregate is the Length of the Night. See the Work following.

H. M.

12 : 00

The Semidiurnal Arch, or Time of Sun setting— 07 : 09

The Complement to 12 Hours is ———— 04 : 51

The Seminocturnal Arch, or Time of Sun-rising, in Latitude 46 Degrees North, is 4 Hours 51 Minutes.

The

H. M.

The Semidiurnal Arch doubled ————— { 07 : 09
07 : 09

The Length of the Day, *April 23, 1745.* is ——— 14 : 18

The Seminocturnal Arch doubled ————— { 04 : 51
04 : 51

The Length of the Night, *April 23, 1745.* is ——— 09 : 42

Example 2. But when the Sun hath 16 deg. 04 min. South Declination, in this Latitude of 46 deg. North ; then the Day-Arch will become the Night-Arch, and the Night-Arch will become the Day-Arch.

As, on *October 26, 1745*, the Sun hath 16 deg. 07 min. South Declination ; then the Time of the Sun's Rising is 7 Hours 10 Minutes, his Setting 4 Hours 50 Minutes ; the Length of the Day 9 Hours 40 Minutes, and the Length of the Night 14 Hours 20 Minutes.

Example 3. Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 15th of *December, 1745*, in Latitude 53 deg. North ; at which Time the Sun's Declination is 23 deg. 24 min. South ?

H. M.

12 : 00

The Seminocturnal Arch, or Time of Sun-rising 08 : 21

The Complement to 12 Hours is ——— 03 : 39

And is the Semidiurnal Arch, or Time of Sun-setting.

The Semidiurnal Arch doubled ————— { 03 : 39
03 : 39

The Length of the Day, *December 15, 1745,* 07 : 18

The Seminocturnal Arch doubled ————— { 08 : 21
08 : 21

The Length of the Night, *December 15, 1745,* is 16 : 42

These

These Tables will serve as well in South Latitude as in North, with this Alteration only. When in South Latitude, then use South Declination there, as you do North Declination here, in North Latitude.

For then these Tables shew the Semidiurnal Arch, or the Time of Sun-rising, when the Sun hath South Declination; and the Seminocturnal Arch, or the Time of Sun-setting, when the Sun hath North Declination.

Example 4. Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 23^d of *April*, 1746. in Latitude 46 Degrees South.

At which Time the Sun's Declination is 16 Degrees 00 Minutes North ; with which enter the Table, and the Seminocturnal Arch is 7 Hours 9 Min. the Time of Sun-rising ; whose Complement to 12 Hours is the Semidiurnal Arch, or Time of Sun-setting, which is at 51 Minutes past 4 of the Clock. H. M.

[illegible]

The Length of the Night, *April 23, 1746.* } 14 : 18
in Latitude 46 Deg. South _____ }

in Latitude 46 Deg. South

The Semidiurnal Arch doubled $\frac{1}{2}$ $\frac{1}{2}$ } 04 : 51
 } 04 : 51

The Length of the Day, the 23d of April } 09 : 42
1746. Latitude 46 Degrees South————— }

Example 5. Let it be required to find the Time of the Sun's Rising and Setting, with the Length of the Day and Night, for the 15th of *December*, 1746. in Latitude 53 Degrees South. At which Time the Sun's Declination is 23 Deg. 24 Min. South; with which enter the Table of Semidiurnal Arches, &c. and you will find as follows.

Н. М.

H. M.

12 : 00

The Semidiurnal Arch, or Time of Sun-setting 08 : 21

The Seminocturnal Arch, or Time of Sun-rising 03 : 39

The Length of the Day _____ 16 : 42

Length of the Night, *December. 15. 1746.* } 07 : 18

Latitude 53 Degrees S. _____ }

To find the Time of a Star's Rising or Setting.

BY these Tables the Time of the Rising and Setting of all Stars in the Heavens (whose Declinations do not exceed the Sun's greatest Declination,) in any Latitude that the Tables contain, and at any Time of the Year, is found in this Manner.

If the Star hath North Declination, and you in North Latitude, look for the Latitude in the Head of the Table, the Declination on the Left-hand, and in the common Angle of meeting is the Stars Semidiurnal Arch, or half the Time of the Star's Continuance above the Horizon, in that Latitude; or the Distance of the Time that Star is in ascending from the Horizon to the Meridian, on the East-side; likewise descending from the Meridian, to the Horizon, on the West-side of the Meridian. Now, if you subtract these Hours and Minutes from the Time of the Star's coming to the Meridian, the Remainder will be the Time of the Star's Rising; and if you add, the Sum will be the true Time of the Star's Setting.

Example 6. Let it be required to find the Time of the Rising and Setting of the *Bull's Eye*, *November* the 18th, in the Latitude of 52 Degrees North: The Declination of this Star is 15 Deg. 55 Min. North; the 18th Day of *November* this Star cometh on the Meridian at 12 a Clock at Night.

H. M.

	H.	M.
The Time of the Star's Southing	12	: 00
The Semi-apparent Arch, subtract	07	: 00
Time of the Star's Rising in the Evening	05	: 00
Time of the Star's Setting in the Morning	07	: 00

Note 1. If the Sum of the Addition exceed 12 Hours, cast away 12 Hours.

2. And when you can't subtract, add 12 Hours to the Star's Southing, and then subtract: What remains is it's Setting.

Example 7. I desire to know the Time of the Rising and Setting of the *Bull's Eye*, the 18th Day of *November*, in the Latitude of 13 deg. North: The Declination of the *Bull's Eye* is 15 deg. 55 min. North?

	H.	M.
The Time of the Star's Southing	12	: 00
The Semi-apparent Arch, subtract	06	: 15
The Time of his Rising in the Evening	05	: 45
The Time of his Setting in the Morning	06	: 15

If the Star hath South Declination, and you in North Latitude, look (as before) the Latitude in the Head of the Table, the Declination on the Left-side, and in the common Angle of meeting is the Star's Semi-depressed Arch; which subtract from 12 Hours, the Remainder is the Star's Semidi-apparent Arch, or half the Time that the Star doth continue above the Horizon in that Latitude: Therefore subtract those Hours and Minutes from the Time of the Star's coming to the Meridian; adding 12 Hours to the Star's Southing, if otherwise Subtraction can't be made, the Remainder will be the Time of the Star's Rising; and if you add, the Sum will be the Time of the Star's Setting.

Example

Example
Rising and
Mouth, t
30 deg. 1
Mouth, is
24 min. in

The Time
To it add
The Sum
The Semi
Which fu
The Rem
Time of S
The Semi
Time of t
Time of t

Example
of the Gre
of 30 Deg

Time of S
The Semi
Time of t

Time of
when I

In South

D O w
South
nation wh

Example 8. Let it be required to find the Time of the Rising and Setting of the bright Star in the *Great Dog's Mouth*, the 15th Day of *November*, in the Latitude of 30 deg. North. The Declination of the *Great Dog's Mouth*, is 16d. 21m. South, and it's Southing is 2 Hours 24 min. in the Morning, the 15th of *November*.

	H.	M.
The Time of this Star's Southing is	02	24
To it add	12	00
The Sum is	14	24
The Seminocturnal Arch, by the Table, is	7	22
Which subtract from	12	00
The Remainder is the Semidiurnal Arch	04	38
Time of Southing, with 12 Hours added, is	14	24
The Semidiurnal Arch, subtract	04	38
Time of the Star's Rising in the Evening	09	46
Time of the Star's Setting in the Morning	17	02

Example 9. I desire to know the Rising and Setting of the *Great Dog* the 15th of *November*, in the Latitude of 30 Degrees North.

	H.	M.
Time of Southing, with 12 Hours added	14	24
The Semidiurnal Arch, subtract	06	39
Time of the Star's Rising in the Evening	07	45
Time of the Star's Setting in the Morning, } when 12 Hours is subtracted	09	03

In South Latitude, to know the Time of the Rising and Setting of the Stars.

DO with those Stars that have North Declination in South Latitude, as with Stars that have South Declination when in North Latitude.

H

Example

Example 10. Let it be required to find the Time of the Rising and Setting of the *Bull's Eye* the 18th Day of *November*, in the Latitude of 42 deg. South.

The Declination of this Star is 15d. 55m. North: The 18th Day of *November* this Star cometh upon the Meridian, at 12 of the Clock at Night.

	H.	M.
The Semidepres'd Arch, by the Table, is —	07	: 00
Which subtract from —	12	: 00
The Remainder is the Semisiderial Arch —	05	: 00
The Time of this Star's Northing is —	12	: 00
The Semisiderial Arch, subtract —	05	: 00
Time of the Star's Rising in the Evening —	07	: 00
Time of the Star's Setting in the Morning —	05	: 00

In like manner the Rising and Setting of any Star (whose Declination exceedeth not the Sun's greatest) may be found in any Latitude, from the Equinoctial to 60 degrees, either North or South Latitude.

A S T R O N O M I C T A B L E S; S H E W I N G,

The Point of the Compass that the Sun and Stars Rise and Set with.

Being of excellent Use for the ready finding of the Variation of the Compass: and may be performed by an ordinary Meridian Compass, but more exactly by an Azimuth Compass.

Fitting all Parts of the World, where the Pole is elevated not above 60 degrees, either North or South.

Latitude

Lat
North
clination
01
East W
1
2
3
e b n w
1
2
3
e n e w

Lat
North
clination
01
East W
1
2
3
e b n w
1
2
3
e n e w

Latitude 0 Degree.			Latitude 1 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination	De- clin	South De- clination.
☉ri ☉set	D M	☉ri ☉set	☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West	East West	0 00	East West
1	2.49	1	1	2.49	1
2	5.37	2	2	5.37	2
3	8.26	3	3	8.26	3
ebn wbn	11.15	ebs wbs	ebn wbn	11.15	ebs wbs
1	14.04	1	1	14.04	1
2	16.52	2	2	16.52	2
3	19.41	3	3	19.41	3
ene wn w	22.30	ese wsw	ene wn w	22.30	ese wsw

Latitude 2 Degrees.			Latitude 3 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D M	☉ri ☉set	☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West	East West	0.00	East West
1	2.49	1	1	2.49	1
2	5.37	2	2	5.37	2
3	8.26	3	3	8.25	3
ebn wbn	11.15	ebs wbs	ebn wbn	11.14	ebs wbs
1	14.04	1	1	14.03	1
2	16.52	2	2	16.51	2
3	19.40	3	3	19.39	3
ene wn w	22.29	ese wsw	ene wn w	22.27	ese wsw

Latitude 4 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ ri ☉ set	D M	☉ ri ☉ set
East West	0.00	East West
1	2.48	1
2	5.37	2
3	8.25	3
ebn wbn	11.14	ebn wbn
1	14.02	1
2	16.50	2
3	19.38	3
ene wnw	22.26	ene wnw

Latitude 5 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ ri ☉ set	D M	☉ ri ☉ set
East West	0.00	East West
1	2.48	1
2	5.37	2
3	8.24	3
ebn wbn	11.12	ebn wbn
1	14.01	1
2	16.49	2
3	19.36	3
ene wnw	22.23	ene wnw

Latitude 6 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ ri ☉ set	D M	☉ ri ☉ set
East West	0.00	East West
1	2.48	1
2	5.36	2
3	8.23	3
ebn wbn	11.11	ebn wbn
1	13.59	1
2	16.47	2
3	19.33	3
ene wnw	22.21	ene wnw

Latitude 7 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ ri ☉ set	D M	☉ ri ☉ set
East West	0.00	East West
1	2.48	1
2	5.35	2
3	8.20	3
ebn wbn	11.09	ebn wbn
1	13.58	1
2	16.45	2
3	19.31	3
ene wnw	22.19	ene wnw

The Mariner's Compass Rectified.

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Latitude 8 Degrees.

Latitude 9 Degrees.

North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
☉ ☽	D M	☉ ☽	☉ ☽	D M	☉ ☽
East West	0.00	East West	East West	0.00	East West
1	2.47	1	1	2.47	1
2	5.35	2	2	5.34	2
3	8.18	3	3	8.17	3
ebn wbn	11.08	ebs wbs	ebn wbn	11.06	ebs wbs
1	13.56	1	1	13.53	1
2	16.43	2	2	16.40	2
3	19.28	3	3	19.25	3
enc wn w	22.15	esc wsw	enc wn w	22.12	esc wsw

Latitude 10 Degrees.

Latitude 11 Degrees.

North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
☉ ☽	D M	☉ ☽	☉ ☽	D M	☉ ☽
East West	0.00	East West	East West	0.00	East West
1	2.47	1	1	2.46	1
2	5.33	2	2	5.31	2
3	8.16	3	3	8.14	3
ebn wbn	11.05	ebs wbs	ebn wbn	11.03	ebs wbs
1	13.51	1	1	13.48	1
2	16.37	2	2	16.33	2
3	19.21	3	3	19.18	3
enc wn w	22.07	esc wsw	enc wn w	22.03	esc wsw

Latitude 12 Degrees.			Latitude 13 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D M	☉ri ☉set	☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West	East West	0.00	East West
1	2.45	1	1	2.45	1
2	5.30	2	2	5.29	2
3	8.12	3	3	8.10	3
ebn wbn	11.00	ebs wbs	ebn wbn	10.57	ebs wbs
1	13.45	1	1	13.42	1
2	16.30	2	2	16.26	2
3	19.14	3	3	19.09	3
ene wnw	21.58	ese wsw	ene wnw	21.53	ese wsw

Latitude 14 Degrees.			Latitude 15 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D M	☉ri ☉set	☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West	East West	0.00	East West
1	2.44	1	1	2.43	1
2	5.28	2	2	5.26	2
3	8.08	3	3	8.06	3
ebn wbn	10.55	ebs wbs	ebn wbn	10.52	ebs wbs
1	13.38	1	1	13.35	1
2	16.22	2	2	16.17	2
3	19.04	3	3	18.59	3
ene wnw	21.47	ese wsw	ene wnw	21.41	ese wsw

Latitude 16 Degrees.			Latitude 17 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0 00	East West	East West	0 00	East West
1	2 45	1	1	2 42	1
2	5 25	2	2	5 23	2
3	8 03	3	3	8 01	3
e by n, w by n	10 45	e by s w by s	e by n w by n	10 45	e by s w by s
1	13 31	1	1	13 26	1
2	16 12	2	2	16 08	2
3	18 55	3	3	18 47	3
e n e w n w	20 34	e s e w s w	e n e w n w	21 27	e s e w s w

Latitude 18 Degrees.			Latitude 19 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0 00	East West	East West	0 00	East West
1	2 41	1	1	2 40	1
2	5 22	2	2	5 20	2
3	7 59	3	3	7 56	3
e by n w by n	10 42	e by s w by s	e by n w by n	10 38	e by s w by s
1	13 22	1	1	13 17	1
2	16 02	2	2	15 56	2
3	18 40	3	3	18 33	3
e n e w n w	21 20	e s e w s w	e n e w n w	21 13	e s e w s w

Latitude 20 Degrees.			Latitude 21 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0 00	East West	East West	0.00	East West
1	2.39	1	1	2.38	1
2	3.17	2	2	5.15	2
3	7.53	3	3	7.50	3
e by n wbyn	10.34	e by s wby s	e by n wbyn	10.30	e by s wby s
1	13.12	1	1	13.07	1
2	15.49	2	2	15.44	2
3	18.27	3	3	18.19	3
e n e w n w	21.05	e s e w s w	e n e w n w	20.55	e s e w s w
			1	21.32	1

Latitude 22 Degrees.			Latitude 23 Degrees.		
North De- clination.	De- clin.	South De- clination.	North De- clination.	De- clin.	South De- clination.
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0.00	East West	East West	0 00	East West
1	2 37	1	1	2.36	1
2	5.13	2	2	5.11	2
3	7.47	3	3	7.43	3
e by n wbyn	10.25	e by s wby s	e by n wbyn	10.21	e by s wby s
1	13.01	1	1	12.56	1
2	15.38	2	2	15.31	2
3	18.11	3	3	18.03	3
e n e w n w	20.46	e s e w s w	e n e w n w	20.37	e s e w s w
1	23.22	1	1	23.11	1

Latitude 24 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ri ⊙set	D.M.	⊙ri ⊙set
East West.	0.00	East West
1	2.35	1
2	5.09	2
3	7.39	3
e by n w by n	10.16	e by s w by s
1	12.50	1
2	15.23	2
3	17.54	3
e n e w n w	20.28	e s e w s w
1	23.00	1

Latitude 25 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ri ⊙set	D.M.	⊙ri ⊙set
East West	0.00	East West
1	2.33	1
2	5.06	2
3	7.36	3
e by n w by n	10.11	e by s w by s
1	12.43	1
2	15.16	2
3	17.46	3
e n e w n w	20.18	e s e w s w
1	22.48	1

Latitude 26 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ri ⊙set	D.M.	⊙ri ⊙set
East West	0.00	East West
1	2.32	1
2	5.04	2
3	7.32	3
e by n w by n	10.06	e by s w by s
1	12.36	1
2	15.08	2
3	17.37	3
e n e w n w	20.07	e s e w s w
1	22.36	1

Latitude 27 Degrees

North De- clination.	De- clin.	South De- clination.
⊙ri ⊙set	D.M.	⊙ri ⊙set
East West	0.00	East West
1	2.31	1
2	5.01	2
3	7.28	3
e by n w by n	10.01	e by s w by s
1	12.30	1
2	15.00	2
3	17.28	3
e n e w n w	19.56	e s e w s w
1	22.23	1

Latitude 28 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D.M.	☉ri ☉set
East West.	0.00	East West
1	2.35	1
2	4.58	2
3	7.20	3
e by n w by n	9.55	e by s w by s
1	12.24	1
2	14.51	2
3	17.17	3
e ne wn w	19.45	e se wsw
1	22.11	1

Latitude 29 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D.M.	☉ri ☉set
East West	0.00	East West
1	2.29	1
2	4.55	2
3	7.20	3
e by n w by n	9.50	e by s w by s
1	12.17	1
2	14.43	2
3	17.07	3
e ne wn w	19.33	e se wsw
1	21.58	1

Latitude 30 Degrees.

North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D.M.	☉ri ☉set
East West	0.00	East West
1	2.27	1
2	4.52	2
3	7.17	3
e by n w by n	9.44	e by s w by s
1	12.09	1
2	14.34	2
3	16.57	3
e ne wn w	19.21	e se wsw
1	21.44	1

Latitude 31 Degrees

North De- clination.	De- clin.	South De- clination.
☉ri ☉set	D.M.	☉ri ☉set
East West	0.00	East West
1	2.25	1
2	4.50	2
3	7.13	3
e by n w by n	9.38	e by s w by s
1	12.01	1
2	14.26	2
3	16.47	3
e ne wn w	19.09	e se wsw
1	21.30	1

Latitude 32 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ ri ⊙ set	D M	⊙ ri ⊙ set
East West	0 00	East West
1	2.23	1
2	4.46	2
3	7.08	3
e b n w b n	9.31	e b s w b s
1	11.54	1
2	14.16	2
3	16.36	3
e n e w n w	18.55	e s e w s w
1	21.16	1

Latitude 33 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ ri ⊙ set	D M	⊙ ri ⊙ set
East West	0.00	East West
1	2.22	1
2	4.43	2
3	7.04	3
e b y n w b y n	9.25	e b y s w b y s
1	11.46	1
2	14.06	2
3	16.24	3
e n e w n w	18.43	e s e w s w
1	21.01	1
2	23.18	2

Latitude 34 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ ri ⊙ set	D M	⊙ ri ⊙ set
East West	0.00	East West
1	2.20	1
2	4.40	2
3	6.59	3
e b y n w b y n	9.18	e b y s w b y s
1	11.38	1
2	13.56	2
3	16.12	3
e n e w n w	18.30	e s e w s w
1	20.46	1
2	23.01	

Latitude 35 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ ri ⊙ set	D M	⊙ ri ⊙ set
East West	0.00	East West
1	2.18	1
2	4.37	2
3	6.54	3
e b n w b n	9.12	e b s w b s
1	11.29	1
2	14.46	2
3	16.02	3
e n e w n w	18.16	e s e w s w
1	20.30	1
2	22.43	2

Latitude 36 Degrees.

North De- clination	De- clin.	South De- clination
☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West
1	2.16	1
2	4.33	2
3	6.49	3
ebn wbn	9.05	ebs wbs
1	11.21	1
2	13.35	2
3	15.49	3
ene wnw	18.02	esc wsw
1	20.15	1
2	22.25	2

Latitude 37 Degrees.

North De- clination	De- clin.	South De- clination
☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West
1	2.15	1
2	4.30	2
3	6.43	3
ebn wbn	8.58	ebs wbs
1	11.12	1
2	13.25	2
3	15.36	3
ene wnw	17.48	esc wsw
1	19.58	1
2	22.07	2

Latitude 38 Degrees.

North De- clination	De- clin.	South De- clination
☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West
1	2.13	1
2	4.26	2
3	6.38	3
ebn wbn	8.50	ebs wbs
1	11.03	1
2	13.14	2
3	15.23	3
ene wnw	17.34	esc wsw
1	19.41	1
2	21.49	2

Latitude 39 Degrees.

North De- clination	De- clin.	South De- clination
☉ri ☉set	D M	☉ri ☉set
East West	0.00	East West
1	2.11	1
2	4.22	2
3	6.32	3
ebn wbn	8.43	ebs wbs
1	10.53	1
2	13.03	2
3	15.10	3
ene wnw	17.18	esc wsw
1	19.25	1
2	21.30	2
3	23.32	3

Latitude

North De- clination.	☉ri ☉set
East West	
1	
2	
3	
ebn wbn	
1	
2	
3	
ene wnw	
1	
2	
3	

Latitude

North De- clination	☉ri ☉set
East West	
1	
2	
3	
ebn wbn	
1	
2	
3	
ene wnw	
1	
2	
3	

Latitude 40 Degrees.

North De- clination.	De- clin.	South De- clination.
Ori ☉ set	D M	Ori ☉ set
East West	0.00	East West
1	2.09	1
2	4.19	2
3	6.27	3
e b n w b n	8.36	e b y s w b s
1	10.43	1
2	12.51	2
3	14.57	3
e n e w n w	17.03	e s e w s w
1	19.07	1
2	21.10	2
3	23.11	3

Latitude 41 Degrees.

North De- clination.	De- clin.	South De- clination.
Ori ☉ set	D M	Ori ☉ set
East West	0.00	East West
1	2.07	1
2	4.15	2
3	6.22	3
e b y n w b y n	8.28	e b y s w b y s
1	10.34	1
2	12.40	2
3	14.44	3
e n e w n w	16.47	e s e w s w
1	18.50	1
2	20.51	2
3	22.50	3

Latitude 42 Degrees.

North De- clination.	De- clin.	South De- clination.
Ori ☉ set	D M	Ori ☉ set
East West	0.00	East West
1	2.06	1
2	4.11	2
3	6.16	3
e b y n w b y n	8.20	e b y s w b y s
1	10.24	1
2	12.28	2
3	14.30	3
e n e w n w	16.31	e s e w s w
1	18.32	1
2	20.31	2
3	22.27	3

Latitude 43 Degrees.

North De- clination.	De- clin.	South De- clination.
Ori ☉ set	D M	Ori ☉ set
East West	0.00	East West
1	2.04	1
2	4.07	2
3	6.10	3
e b n w b n	8.12	e b s w b s
1	10.14	1
2	12.16	2
3	14.16	3
e n e w n w	16.15	e s e w s w
1	18.14	1
2	20.10	2
3	22.05	3

Latitude 44 Degrees.			Latitude 45 Degrees		
North Dec	Decl.	South Decl.	North Dec	Decl	South Decl
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0.00	East West	East West	0.00	East West
1	2.01	1	1	2.00	1
2	4.03	2	2	3.59	2
3	6.04	3	3	5.57	3
e byn wby n	8.04	e by s w by s	e by n wby n	7.56	e by s wby s
1	10.04	1	1	9.54	1
2	12.03	2	2	11.51	2
3	14.01	3	3	13.46	3
e n e w n w	15.59	e s e w s w	e n e w n w	15.42	e s e w s w
1	17.54	1	1	17.36	1
2	19.50	2	2	19.30	2
3	21.42	3	3	21.19	3
nebe nwbw	23.34	sebe c swbw	nebe nwbw	23.08	sebe c swbw

Latitude 46 Degrees.			Latitude 47 Degrees.		
North De- clination	De- clin.	South De- clination.	North De- clination	De- clin.	South De- clination
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0.00	East West	East West	0.00	East West
1	1.58	1	1	1.55	1
2	3.55	2	2	3.50	2
3	5.51	3	3	5.45	3
e byn wby n	7.47	e by s wby s	e by n wby n	7.39	e by s wby s
1	9.43	1	1	9.33	1
2	11.38	2	2	11.25	2
3	13.32	3	3	13.17	3
e n e w n w	15.25	e s e w s w	e n e w n w	15.08	e s e w s w
1	18.17	1	1	16.57	1
2	19.07	2	2	18.46	2
3	20.55	3	3	20.31	3
nebe nwbw	22.42	sebe swbw	nebe nwbw	22.16	sebe swbw

Latitude 48 Degrees.

North De- clination.	De- clin	South De- clination
⊙ri ⊙set	D M	⊙ri ⊙set
East West	0.00	East West
1	1.53	1
2	3.46	2
3	5.38	3
ebn wbn	7.30	ebs wbs
1	9.22	1
2	11.12	2
3	13.01	3
ene wnw	14.50	ese wsw
1	16.38	1
2	18.24	2
3	20.07	3
nebe nwbw	21.49	se be swbw
1	23.29	1

Latitude 49 Degrees

North De- clination	De- clin.	South De- clination
⊙ri ⊙set	D M	⊙ri ⊙set
East West	0.00	East West
1	1.51	1
2	3.42	2
3	5.31	3
ebn wbn	7.22	ebs wbs
1	9.10	1
2	10.59	2
3	12.46	3
ene wnw	14.32	ese wsw
1	16.17	1
2	18.01	2
3	19.42	3
nebe nwbw	21.22	se be swbw
1	23.01	1

Latitude 50 Degrees.

North De- clination	De- clin.	South De- clination.
⊙ri ⊙set	D M	⊙ri ⊙set
East West	0.00	East West
1	1.48	1
2	3.37	2
3	5.25	3
ebn wbn	7.12	ebs wbs
1	8.59	1
2	10.46	2
3	12.30	3
ene wnw	14.14	ese wsw
1	15.57	1
2	17.39	2
3	19.18	3
nebe nwbw	20.55	se be swbw
1	22.31	1

Latitude 51 Degrees.

North De- clination.	De- clin.	South De- clination.
⊙ri ⊙set	D M	⊙ri ⊙set
East West	0.00	East West
1	1.46	1
2	3.33	2
3	5.18	3
ebn wbn	7.04	ebs wbs
1	8.48	1
2	10.32	2
3	12.14	3
ene wnw	13.56	ese wsw
1	15.36	1
2	17.16	2
3	18.52	3
nebe nwbw	20.28	se be swbw
1	22.01	1
2	23.30	2

Latitude 52 Degrees.			Latitude 53 Degrees		
North Dec	Decl.	South Decl	North Dec	Decl	South Decl
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	0 00	East West	East West	0 00	East West
1	1.44	1	1	1.42	1
2	3.28	2	2	3.23	2
3	5.11	3	3	5.04	3
e byn wby n	6.54	e by s w by s	e by n wbyn	6.44	e by s wby n
1	8.37	1	1	8.25	1
2	10.18	2	2	10.04	2
3	11.58	3	3	11.41	3
e n e w n w	13.37	e s e w s w	e n e w n w	13.19	e s e w s w
1	15.16	1	1	14.55	1
2	16.52	2	2	16.29	2
3	18.27	3	3	18.01	3
nebe nwbw	20.00	se b e swbw	nebe nwbw	19.32	se b e swbw
1	21.31	1	1	21.01	1
2	23.00	2	2	22.27	2

Latitude 54 Degrees.			Latitude 55 Degrees.		
North Declination	Decl.	South Declination.	North Declination.	Decl.	South Declination.
⊙ri. ⊙set	D M	⊙ri. ⊙set	⊙ri. ⊙set	D M	⊙ri. ⊙set
East West	6.00	East West	East West	0 00	East West
1	1.39	1	1	1.37	1
2	3.18	2	2	3.14	2
3	4.57	3	3	4.49	3
e byn wby n	6.35	e by s w by s	e byn wbyn	6.25	e by s w by s
1	8.13	1	1	8.01	1
2	9.50	2	2	9.35	2
3	11.25	3	3	11.08	3
e n e w n w	13.00	e s e w s w	e n e w n w	12.41	e s e w s w
1	14.33	1	1	14.12	1
2	16.05	2	2	15.42	2
3	17.35	3	3	17.09	3
nebe nwbw	19.03	sebe swbw	nebe nwbw	18.35	sebe swbw
1	20.30	1	1	19.59	1
2	21.54	2	2	21.21	2
3	23.15	3	3	22.39	3

Latitude 56 Degrees.

North Decl.	Decl.	South Decl.
⊙ Ori. ⊙ set.	D. M.	⊙ Ori. ⊙ set.
East West	0.00	East West
1	1.34	1
2	3.09	2
3	4.42	3
ebyn wbyn	6.16	ebys w by s
1	7.49	1
2	9.21	2
3	10.51	3
ene wn w	12.22	ese wsw
1	13.50	1
2	15.18	2
3	16.42	3
nebe nwbw	18.06	sebe swbw
1	19.28	1
2	20.47	2
3	22.03	3
ne nw	23.18	se sw

Latitude 57 Degrees.

North Decl.	Decl.	South Decl.
⊙ Ori. ⊙ set.	D. M.	⊙ Ori. ⊙ set.
East West	0.00	East West
1	1.32	1
2	3.04	2
3	4.35	3
ebyn wbyn	6.06	ebys w by s
1	7.36	1
2	9.06	2
3	10.34	3
ene wn w	12.01	ese wsw
1	13.28	1
2	14.53	2
3	16.16	3
nebe nwbw	17.37	sebe swbw
1	18.56	1
2	20.13	2
3	21.27	3
ne n w	22.39	se s w

Latitude 58 Degrees.

East West	0.00	East West
1	1.30	1
2	2.59	2
3	4.28	3
ebyn wbyn	5.56	ebys w by s
1	7.24	1
2	8.51	2
3	10.17	3
ene wn w	11.42	ese wsw
1	13.06	1
2	14.28	2
3	15.48	3
nebe nwbw	17.07	sebe swbw
1	18.24	1
2	19.38	2
3	20.50	3
ne nw	2.00	se sw
1	23.08	1

Latitude 59 Degrees.

East West	0.00	East West
1	1.27	1
2	2.54	2
3	4.20	3
ebyn wbyn	5.46	ebys w by s
1	7.11	1
2	8.36	2
3	10.00	3
ene wn w	11.22	ese wsw
1	12.44	1
2	14.03	2
3	15.21	3
nebe nwbw	16.37	sebe swbw
1	17.52	1
2	19.04	2
3	20.14	3
ne n w	21.22	se sw
1	22.26	1
2	23.27	2

Latitude 60 Degrees.

North Declination.			South Declination.		
☉ rise.	D.M.	☉ set	☉ rise	D.M.	☉ set
East	0 00	West	East	0.00	West
1	1.25	1	1	1.25	1
2	2.49	2	2	2.49	2
3	4.12	3	3	4.12	3
e by n	5.36	w by n	e by s	5.36	w by s
1	6.59	1	1	6.59	1
2	8.21	2	2	8.21	2
3	9.42	3	3	9.42	3
e n e	11.02	w n w	e s e	11.02	w s w
1	12.21	1	1	12.21	1
2	13.38	2	2	13.38	2
3	14.53	3	3	14.52	3
n e by e	16.08	n w by w	s e by e	16.08	s w by w
1	17.20	1	1	17.20	1
2	18.30	2	2	18.30	2
3	19.38	3	3	19.38	3
n e	20.42	n w	s e	20.42	s w
1	21.45	1	1	21.45	1
2	22.44	2	2	22.44	2

The Description and Use of the foregoing TABLES.

1. **THESE** Tables of *Points of the Compass* (at which the Sun or any Star, whose Declination exceeds not 23 deg. 29 min.) begin at Latitude 0 Deg. and proceed orderly to 60 Deg. (being some four, some two Tables, in one Page) and sixty-one in all.

2. In each Table are five Columns; the middlemost contains the Degrees of Declination, either North or South; those two on each side of it, mark'd ☉ rise, ☉ set (under *North* and *South Declination*) stand for Sun-rising and Sun-setting.

3. The

The first and second Columns, (under *North Declination*) as also the fourth and fifth Columns (under *South Declination*) contain the Points, and each Quarter of a Point of the Compass, of both *Rising* and *Setting*: Thus, *East, West*, under which is 1, 2, 3; that is, *East* or *West* 1 Quarter, 2 Quarters, 3 Quarters, *Northerly* or *Southerly*; then *E by N. W by N.* under which is 1, 2, 3; that is, *E by N.* or *W by N.* 1 Quarter, 2 Quarters *Northerly, &c.*

These Tables are ready Helps for finding the Variation of the Compass with Ease and sufficient Exactness; evidently made out in the following Uses.

To find the Point of the Compass that the Sun Riseth or Setteth with, at any Time of the Year.

FIRST, seek the Sun's Declination, in the Table of Declination for the Time proposed; with which enter the foregoing Table, finding the Latitude in the Head of the Table, and the Declination in the third Column; against which, on the Left-hand, if it be North Declination, but on the Right-hand if it be South Declination, is the Point of the Compass that the Sun rises or sets at, according to the Titles at the Head of the Table.

Note, These Tables shew the true Points of the Sun's Rising or Setting; so that you may readily know at any Time, seeing the Sun rise or set, the Variation by an ordinary Meridian Compass.

There are some Compasses not touched so well as they ought to be; others, in Time, the Virtue of the Stone wears off from the Needle.

Now, by these foregoing Tables, you may very readily discover any of these Defects.

But it may be objected, they cannot set the Sun by an ordinary Meridian Compass, so near as is required.

To this I answer, it's as easy to set the Sun by the Compass, as to steer a Ship by it; for expert Seamen can set the Sun, or a Headland, to near a Quarter of a Point by their Hand, (but with Sights much nearer the Truth.) The Posture to observe in such a Case I advise, is thus;

Set the Compass about two Foot high, and directing your Hand towards the Sun, note what Point, Half-Point, or Quarter-Point, the Sun riseth, or setteth on; then, in that Table belonging to the Latitude, see whether the Sun riseth, or sets that Day upon the same Point, found by Observation: If they agree, there is no Variation; but if they do not agree, the Compass is not true, or there is Variation; and the Variation is so much, as is the Difference between the Observation and the Table.

Example 1. Admit in Latitude 30 Degrees North, the Sun having 9 Degrees 44 Minutes North Declination; I observe the Sun that Day to rise upon the E N E. Point of the Compass: I demand the Variation?

In the Head of the foregoing Tables look for the Latitude 30 Degrees, and in the third Column for 9 deg. 44 min. North Declination; and against it (under ☉ rise) is E by N. which sheweth that there is one Point Variation. For it appears by the Table, that the E N E. Point on the Compass is the true E by N. Point; and the E by N. (as its upon the Compass) is the true East Point; the East Point is the true E by S. the S E. is the S E by S. and the South is the S by W. the West is the W. by N. and the North is the N by E.

This plainly appears by the *Rectifier*, if you bring the E by N. on the outward Circle, right against the E N E. on the inward Circle.

Now, suppose we were to observe the Sun at his Setting, in the Latitude of 30 deg. with Declination 9 deg. 44m. North, as abovesaid, we should find the Sun to set exactly at West by the Compass, although in the Morning

Morning we did find the Sun to rise at E N E. I know this will be little less than a Contradiction to some; but if you cast your Eye upon the *Rectifier*, you may see it's a certain Truth.

Example 2. In Latitude 37 deg. North, the Sun's Declination 8 deg. 58 min. North, I observe the Sun to rise E by N. by the Compass: I demand the Variation?

In the Table that belongs to 37 deg. against 8 deg. 58 min. North Declination, and under ☉ Rise, is E by N. which sheweth there is no Variation, because the Observation agreeth with the Table.

Note, If the Declination for the Day proposed be not the same with the Declination in the Tables, then have regard to the nearest, allowing for the Difference.

Example 3. In Latitude 37 deg. North, suppose the Sun's Declination 10 deg. 15 min. North, I demand the Point of the Compass that the Sun should rise with?

In the Tables the nearest to 10 deg. 15 min. is 11 deg. 12 min. against which the Sun riseth E by N. $\frac{1}{4}$ N. and sets West by North $\frac{1}{4}$ North; but in the Table for 37 deg. Latitude, the Declination proposed, is near about the middle, between 8 deg. 48 min. and 11 deg. 12 min. Therefore the Sun riseth E by N. half a Quarter N. and setteth W by N. half a Quarter N.

Understand the like in any other Case, let the Declination be what it will in any other Latitude.

Example 4. Admit in Latitude 38 deg. 20 min North, and Declination 19 deg. 50 min. South: The Sun riseth upon the E S E. Point of the Compass: I demand the Variation?

In the Table for Latitude 38 deg. and against 19 deg. 41 min. (the nearest to the given Declination) is E S E. a Quarter S which sheweth that there is a Quarter of a Point Variation. For the E S E. Point is E S E. $\frac{1}{4}$ S. and the North Point is N $\frac{1}{4}$ E. For if you do bring E S E. $\frac{1}{4}$ S. on the outward Circle of the *Rectifier*, right against E S E. on the inward Circle, then S. S. W. on the

Compass is S S W. $\frac{1}{4}$ W. and S E. is S E $\frac{1}{4}$ S. and East is E $\frac{1}{4}$ S. And so for any other Point, Half-Point, or Quarter-Point, by casting your Eye upon the *Rectifier*.

Note, The Tables shew the true Points of Rising and Setting, and the outward Circle on the *Rectifier* doth the same; but the Compass, when it differeth from the Tables, sheweth a false Point; and the inward Circle on the *Rectifier* doth the same.

Example 5. Admit in Latitude 47d. 24m. North, the Declination 15d. 2m. South, the Sun rising E by S. by the Compass; I demand the Variation?

By the Tables the Sun should rise E S E. therefore there is one Point Variation: For if you bring the E S E. on the outward Circle of the *Rectifier*, over against the E by S. on the inward Circle, then the N by W. on the Compass is the true North Point; the N W. is the N W. by N. and the S. by E. is the true South Point.

By this Time I suppose my Reader able to discover how much the Variation is, and how to reckon it without any *Geometric Demonstration*, or *Arithmetic Calculation*.

Note, If you have any odd Minutes of Latitude, go to that Table nearest the Latitude you are in.

I come now to resolve a Question some are puzzled with; and that is this:

Quest. If the Sun rise at E N E. in any Latitude, should he not set the same Day at W N W. in the same Latitude?

Ans. If there be no Variation, it will; but if there be Variation, it will not be so: The Reason is evident by the *Rectifier*.

By these Tables you may know the Point of the Compass that any of the Stars do rise and set at, in any Latitude the Tables contain, either North or South, if their Declination do not exceed the Sun's greatest Declination.

Example 6. Let it be required to find the Point of the Compass the *Bull's Eye* rises and sets with, in the Latitude of 50 deg. North?

The Declination of this Star is 15d. 55m. North; in the Table that belongs to 50d. against 15d. 57m. North Declination, the Point of Rising is E. N. E. $\frac{1}{4}$ N. and the Point of Setting is W. N. W. $\frac{1}{4}$ N.

Understand the like for any other Star, whose Declination exceeds not the Sun's greatest Declination.

The Use of the Rectifier.

THIS Instrument, as before described (in Page 93, 94, and 95.) containeth two Circles or Compasses, one within the other; but as it's made of Wood, the one moveth upon the other, and by the Compass when it doth vary may be rectified, as followeth:

Bring the true Point of Rising or Setting (as the Table sheweth) on the Outward or Under Compass, right against the false Point of Rising or Setting (as your Compass sheweth) on the Inward or Upper Compass; then will the Under Compass rectify the Upper.

Examp. 7. Admit in Lat. 45d N. the Sun's Declination being 7d. 56m. South, the Sun setting upon the W. by N. Point of the Compass, I demand the Variation?

The Sun (if there be no Variation) will set at W. by S. and rise at E. by S. as the Table sheweth; therefore it appears there is two Points Variation.

Bring the W. by S. Point on the outward Compass; right against the W. by N. Point on the inward Compass; then the Points upon the outward Compass do explain the Points that are upon the inward: So that, according to the foregoing Observation, the N. N. E. Point on the Compass is the true North; the North is the true NNW. the W. by N. is the true W. by S. the S. E. by E. is the true E. by S. And so for any other Point of the Compass, by only looking on the *Rectifier*.

And thus you may rectify the Compass, without reckoning which way the Variation is, either Eastward or Westward: The *Rectifier* doth it so plain, that you can't be mistaken.

A Table of Amplitudes, fitting all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South

The Degrees of Latitude.

Sun's Declin.	1		2		3		4		5		6	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	00	01	00	01	00	01	00	01	00	01	00
2	02	00	02	00	02	00	02	00	02	00	02	00
3	03	00	03	00	03	00	03	00	03	00	03	01
4	04	00	04	00	04	00	04	00	04	01	04	01
5	05	00	05	00	05	00	05	00	05	01	05	01
6	06	00	06	00	06	00	06	01	06	01	06	02
7	07	00	07	00	07	00	07	01	07	01	07	02
8	08	00	08	00	08	01	08	01	08	02	08	02
9	09	00	09	00	09	01	09	01	09	02	09	02
10	10	00	10	00	10	01	10	01	10	02	10	03
11	11	00	11	00	11	01	11	01	11	02	11	03
12	12	00	12	00	12	01	12	01	12	03	12	04
13	13	00	13	00	13	01	13	01	13	03	13	04
14	14	00	14	00	14	01	14	02	14	03	14	04
15	15	00	15	00	15	01	15	02	15	03	15	05
16	16	00	16	01	16	01	16	02	16	04	16	05
17	17	00	17	01	17	01	17	02	17	04	17	05
18	18	00	18	01	18	01	18	02	18	04	18	06
19	19	00	19	01	19	01	19	02	19	04	19	06
20	20	00	20	01	20	02	20	03	20	05	20	06
21	21	00	21	01	21	02	21	03	21	05	21	07
22	22	00	22	01	22	02	22	03	22	05	22	07
23	23	00	23	01	23	02	23	03	23	05	23	08
23, 29	23	29	23	30	23	32	23	33	23	35	23	37

A Table

Sun's
Declin.

Degrees of Declination.

20
21
22
23
23, 29

A Table of Amplitudes, fitting all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude

Sun's Declin.	7		8		9		10		11		12	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	00	01	00	01	00	01	01	01	01	01	01
2	02	01	02	01	02	01	02	02	02	02	02	03
3	03	01	03	01	03	01	03	03	03	03	03	04
4	04	02	04	02	04	02	04	04	04	04	04	05
5	05	02	05	02	05	03	05	05	05	05	05	07
6	06	02	06	03	06	04	06	06	06	06	06	08
7	07	03	07	04	07	05	07	07	07	08	07	09
8	08	03	08	04	08	06	08	08	08	09	08	11
9	09	04	09	05	09	06	09	09	09	10	09	12
10	10	04	10	06	10	07	10	10	10	11	10	13
11	11	05	11	06	11	08	11	11	11	13	11	15
12	12	05	12	07	12	09	12	12	12	14	12	16
13	13	06	13	08	13	09	13	13	13	15	13	17
14	14	06	14	08	14	10	14	14	14	16	14	19
15	15	07	15	09	15	11	15	15	15	17	15	20
16	16	07	16	10	16	12	16	16	16	19	16	22
17	17	08	17	10	17	13	17	17	17	20	17	23
18	18	08	18	11	18	14	18	18	18	21	18	25
19	19	09	19	12	19	15	19	19	19	22	19	26
20	20	09	20	12	20	16	20	20	20	24	20	28
21	21	10	21	13	21	17	21	21	21	25	21	29
22	22	10	22	13	22	18	22	22	22	27	22	31
23	23	11	23	14	23	19	23	23	23	28	23	33
23, 29	23	40	23	45	23	50	23	54	23	59	24	05

A Table of Amplitudes, fitting all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Declin.	13		14		15		16		17		18	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	02	01	02	01	02	01	02	01	02	01	03
2	02	03	02	04	02	04	02	05	02	05	02	06
3	03	05	03	05	03	06	03	07	03	08	03	09
4	04	06	04	07	04	08	04	10	04	11	04	12
5	05	08	05	09	05	10	05	12	05	13	05	15
6	06	10	06	11	06	13	06	15	06	17	06	19
7	07	11	07	13	07	15	07	17	07	19	07	22
8	08	13	08	15	08	17	08	19	08	22	08	25
9	09	14	09	17	09	19	09	21	09	25	09	28
10	10	16	10	19	10	21	10	24	10	28	10	31
11	11	17	11	20	11	23	11	27	11	30	11	34
12	12	19	12	22	12	25	12	29	12	33	12	38
13	13	20	13	24	13	27	13	32	13	36	13	41
14	14	22	14	26	14	30	14	34	14	39	14	44
15	15	24	15	28	15	32	15	37	15	42	15	47
16	16	26	16	30	16	35	16	40	16	45	16	51
17	17	28	17	32	17	37	17	42	17	48	17	54
18	18	30	18	34	18	39	18	45	18	51	18	58
19	19	31	19	36	19	42	19	48	19	54	20	01
20	20	33	20	38	20	44	20	51	20	57	21	04
21	21	35	21	40	21	46	21	53	22	00	22	08
22	22	37	22	43	22	49	22	56	23	04	23	12
23	23	39	23	45	23	51	23	58	24	06	24	15
23, 29	24	41	24	46	24	52	24	59	24	40	24	49

A Table of
to

Sun's
Declin.

Degrees of Declination.

A Table of Amplitudes, fitting all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Declin.	19		20		21		22		23		24	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	03	01	04	01	04	01	05	01	05	01	06
2	02	07	02	08	02	08	02	09	02	10	02	12
3	03	10	03	12	03	13	03	14	03	15	03	17
4	04	14	04	16	04	17	04	19	04	21	04	23
5	05	17	05	19	05	21	05	23	05	26	05	28
6	06	21	06	23	06	26	06	28	06	31	06	34
7	07	24	07	27	07	30	07	33	07	37	07	40
8	08	28	08	31	08	34	08	38	08	42	08	46
9	09	31	09	35	09	39	09	43	09	47	09	51
10	10	35	10	39	10	43	10	48	10	52	10	57
11	11	38	11	43	11	48	11	53	11	58	12	03
12	12	42	12	47	12	52	12	58	13	03	13	09
13	13	46	13	51	13	57	14	03	14	09	14	15
14	14	50	14	55	15	01	15	08	15	14	15	21
15	15	53	16	00	16	06	16	13	16	20	16	27
16	16	57	17	04	17	11	17	18	17	26	17	34
17	18	01	18	08	18	15	18	23	18	31	18	40
18	19	05	19	12	19	20	19	28	19	37	19	46
19	20	08	20	16	20	24	20	33	20	42	20	52
20	21	12	21	20	21	29	21	39	21	49	21	59
21	22	16	22	25	22	34	22	44	22	55	23	06
22	23	20	23	29	23	39	23	50	24	01	24	12
23	24	24	24	34	24	44	24	55	25	07	25	19
23, 29	24	58	25	08	25	18	25	29	25	41	25	54

Degrees of Declination.

*A Table of Amplitudes, fitting all Places from the Equinoctial
to 60 Degrees of Latitude, either North or South.*

The Degrees of Latitude.

Swiss Declin.	25		26		27		28		29		30	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	06	01	07	01	08	01	08	01	09	01	09
2	02	12	02	13	02	15	02	16	02	17	02	18
3	03	18	03	20	03	22	03	24	03	26	03	28
4	04	25	04	27	04	29	04	32	04	34	04	37
5	05	33	05	33	05	37	05	40	05	43	05	46
6	06	37	06	41	06	44	06	48	06	52	06	56
7	07	43	07	48	07	51	07	56	08	01	08	06
8	08	50	08	54	08	59	09	04	09	09	09	15
9	09	56	10	01	10	06	10	12	10	18	10	24
10	11	03	11	08	11	14	11	21	11	27	11	34
11	12	09	12	15	12	21	12	28	12	36	12	44
12	13	16	13	23	13	30	13	37	13	45	13	53
13	14	22	14	30	14	37	14	45	14	54	15	03
14	15	29	15	37	15	45	15	54	16	03	16	12
15	16	35	16	44	16	53	17	03	17	12	17	23
16	17	42	17	51	18	01	18	11	18	21	18	32
17	18	49	18	59	19	09	19	20	19	31	19	43
18	19	56	20	06	20	17	20	29	20	41	20	54
19	21	02	21	13	21	25	21	38	21	51	22	05
20	22	10	22	22	22	34	22	48	23	02	23	16
21	23	18	23	30	23	43	23	57	24	12	24	27
22	24	24	24	37	24	51	25	06	25	22	25	38
23	25	32	25	46	26	01	26	16	26	32	26	49
23, 29	26	08	26	23	26	37	26	52	27	08	27	55

A Table of Amplitudes, fitting all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Declin.	31	32	33	34	35	36
	D M	D M	D M	D M	D M	D M
0	00 00	00 00	00 00	00 00	00 00	00 00
1	01 10	01 10	01 11	01 12	01 13	01 14
2	02 19	02 21	02 23	02 25	02 27	02 29
3	03 30	03 33	03 35	03 38	03 40	03 43
4	04 40	04 43	04 46	04 50	04 53	04 57
5	05 50	05 54	05 58	06 02	06 06	06 11
6	07 00	07 05	07 10	07 15	07 20	07 25
7	08 11	08 16	08 21	08 27	08 33	08 40
8	09 21	09 27	09 33	09 39	09 46	09 54
9	10 31	10 38	10 45	10 52	11 00	11 08
10	11 41	11 48	11 55	12 03	12 12	12 21
11	12 52	13 00	13 09	13 18	13 28	13 39
12	14 02	14 11	14 21	14 32	14 43	14 54
13	15 13	15 23	15 33	15 44	15 56	16 09
14	16 22	16 33	16 45	16 57	17 10	17 24
15	17 34	17 46	17 58	18 11	18 25	18 40
16	18 44	18 57	19 11	19 25	19 40	19 55
17	19 56	20 10	20 24	20 39	20 55	21 11
18	21 07	21 21	21 36	21 53	22 10	22 27
19	22 19	22 34	22 50	23 07	23 25	23 44
20	23 31	23 47	24 04	24 22	24 41	25 00
21	24 43	25 00	25 18	25 37	25 56	26 17
22	25 55	26 13	26 32	26 52	27 13	27 35
23	27 07	27 26	27 46	28 07	28 29	28 52
23, 29	27 43	28 03	28 23	28 45	29 05	29 32

A Table of Amplitudes, fitting all Places from the Equinoctial to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Declin.	37		38		39		40		41		42	
	D	M	D	M	D	M	D	M	D	M	D	M
0	08	00	00	00	00	00	00	00	00	00	00	00
1	01	15	01	16	01	17	01	18	01	20	01	21
2	02	30	02	32	02	34	02	36	02	39	02	41
3	03	45	03	48	03	51	03	54	03	58	04	01
4	05	00	05	04	05	08	05	13	05	18	05	23
5	06	16	06	21	06	26	06	32	06	38	06	44
6	07	31	07	37	07	43	07	50	07	57	08	05
7	08	47	08	54	09	01	09	09	09	17	09	26
8	10	02	10	10	10	19	10	28	10	37	10	47
9	11	17	11	27	11	37	11	47	11	58	12	09
10	12	32	12	43	12	54	13	06	13	18	13	31
11	13	50	14	01	14	13	14	26	14	39	14	53
12	15	06	15	18	15	31	15	45	16	00	16	15
13	16	22	16	35	16	49	17	04	17	20	17	37
14	17	38	17	52	18	08	18	24	18	42	19	00
15	18	55	19	11	19	28	19	45	20	04	20	23
16	20	11	20	28	20	46	21	05	21	25	21	46
17	21	28	21	46	22	06	22	26	22	48	23	10
18	22	48	23	05	23	25	23	47	24	10	24	34
19	24	04	24	24	24	46	25	09	25	33	25	58
20	25	21	25	43	26	06	26	30	26	56	27	24
21	26	39	27	02	27	27	27	53	28	21	28	50
22	27	58	28	23	28	49	29	16	29	45	30	16
23	29	17	29	43	30	11	30	40	31	11	31	43
23, 29	29	58	30	24	30	52	31	22	31	54	32	28

Degrees of Declination.

Sun's
Declin.

Degrees of Declination.

A Table of Amplitudes, fitting all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude

Sun's Declin.	43		44		45		46		47		48	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	22	01	23	01	25	01	26	01	28	01	29
2	02	44	02	47	02	50	02	53	02	56	02	59
3	04	06	04	10	04	15	04	19	04	24	04	29
4	05	28	05	34	05	40	05	46	05	52	05	59
5	06	51	06	58	07	05	07	12	07	20	07	29
6	08	13	08	21	08	30	08	39	08	49	08	59
7	09	35	09	45	09	56	10	06	10	18	10	30
8	10	58	11	09	11	21	11	34	11	47	12	00
9	12	21	12	34	12	47	13	01	13	16	13	31
10	13	44	13	58	14	13	14	28	14	44	15	02
11	15	07	15	22	15	38	15	56	16	15	16	34
12	16	31	16	48	17	06	17	25	17	45	18	06
13	17	55	18	13	18	33	18	54	19	16	19	39
14	19	18	19	39	20	00	20	23	20	47	21	12
15	20	43	21	05	21	28	21	52	22	18	22	45
16	22	08	22	32	22	56	23	23	23	50	24	20
17	23	34	23	59	24	25	24	53	25	23	25	55
18	24	59	25	26	25	54	26	25	26	57	27	31
19	26	25	26	54	27	25	27	58	28	32	29	07
20	27	53	28	23	28	56	29	31	30	07	30	45
21	29	20	29	53	30	27	31	03	31	42	32	23
22	30	48	31	22	31	58	32	37	33	18	34	03
23	32	16	32	51	33	30	34	12	34	56	35	43
23, 29	33	03	33	40	34	20	35	03	35	48	36	35

Degrees of Declination.

A Table of Amplitudes, fixing all Places from the Equinoctial, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Declin.	49		50		51		52		53		54	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	31	01	33	01	35	01	37	01	39	01	42
2	03	03	03	06	03	10	03	15	03	20	03	24
3	04	34	04	40	04	46	04	52	04	59	05	06
4	06	06	06	14	06	22	06	30	06	39	06	49
5	07	38	07	48	07	58	08	08	08	19	08	31
6	09	10	09	21	09	33	09	46	10	00	10	15
7	10	42	10	55	11	09	11	24	11	40	11	57
8	12	14	12	29	12	45	13	02	13	21	13	41
9	13	47	14	05	14	24	14	43	15	04	15	26
10	15	21	15	40	16	01	16	23	16	46	17	11
11	16	54	17	16	17	39	18	03	18	29	18	57
12	18	28	18	52	19	18	19	44	20	12	20	43
13	20	03	20	29	20	57	21	26	21	57	22	30
14	21	38	22	06	22	37	23	08	23	42	24	18
15	23	14	23	45	24	18	24	52	25	28	26	07
16	24	51	25	24	25	59	26	36	27	16	27	58
17	26	28	27	03	27	41	28	21	29	04	29	50
18	28	06	28	43	29	24	30	07	30	53	31	42
19	29	45	30	25	31	08	31	55	32	45	33	38
20	31	25	32	08	32	54	33	44	34	39	35	35
21	33	06	33	52	34	41	35	34	36	31	37	37
22	34	48	35	37	36	30	37	27	38	29	39	26
23	36	33	37	26	38	23	39	24	40	29	41	40
23, 29	37	26	38	20	39	19	40	23	41	29	42	46

A Tab

Sun's Declin.

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Degrees of Declination.

A Table of Amplitudes, fitting all Places from the Equinoctial to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Declin.	55		56		57		58		59		60	
	D	M	D	M	D	M	D	M	D	M	D	M
0	00	00	00	00	00	00	00	00	00	00	00	00
1	01	45	01	47	01	50	01	53	01	56	02	00
2	03	29	03	34	03	40	03	46	03	53	04	00
3	05	14	05	22	05	31	05	40	05	50	06	00
4	06	59	07	10	07	22	07	34	07	47	08	01
5	08	44	08	57	09	11	09	26	09	43	10	02
6	10	30	10	47	11	04	11	22	11	42	12	04
7	12	15	12	35	12	56	13	18	13	41	14	06
8	14	02	14	24	14	48	15	14	15	41	16	10
9	15	49	16	14	16	45	17	10	17	41	18	14
10	17	37	18	05	18	33	19	07	19	41	20	18
11	19	26	19	56	20	29	21	04	21	43	22	26
12	21	15	21	49	22	25	23	04	23	47	24	34
13	23	05	23	43	24	23	25	07	25	54	26	44
14	24	56	25	37	26	21	27	09	28	01	28	55
15	26	49	27	34	28	22	29	14	30	12	31	09
16	28	43	29	32	30	24	31	21	32	22	33	27
17	30	39	31	31	32	27	33	28	34	32	35	47
18	32	35	33	33	34	34	35	40	36	53	38	09
19	34	35	35	36	36	46	37	54	39	13	40	36
20	36	36	37	42	38	53	40	12	41	37	43	10
21	38	39	39	51	41	09	42	34	44	05	45	48
22	40	47	42	04	43	27	44	59	46	40	48	32
23	42	56	44	19	45	50	47	50	49	21	51	24
23, 29	44	00	45	27	47	02	48	46	50	47	52	51

The Use of these Table of Amplitude.

THE Sun, or Star's Amplitude, is the Distance of the Rising or Setting of the Sun or Star from the East or West Points of the Horizon, either Northerly or Southerly.

Note, When the Sun or Stars have North Declination, they rise to the Northward of the East, and set to the Northward of the West: But if their Declination be South, they rise to the Southward of the East, and set to the Southward of the West; And by these Tables it is thus found, *viz.*

Look the Latitude in the Head of the Table, the Declination in the first Column on the Left hand; and in the common Angle of meeting is the *Amplitude* desired.

Example 1. In the Latitude of 30 deg the Sun's Declination being 7d. 0m. North, I demand the *Amplitude*?

Ans. The *Amplitude* is 8 deg. 6 min. For under Latitude 30 d. in Page 140, and against Declination 7d. you will find 8 d. 6 m. which is the Amplitude from the East Northward at Sun-rising, and from the West Northward at Sun-setting. But if the Declination had been 7d. 0m. South, in Latitude 30 d. as aforesaid, then the *Amplitude* would have been 8d. 6m. from the East Southward at Sun rising, and 8d. 6m. from the West Southward at Sun-setting.

If there be any odd Minutes of Declination, take the Proportional Part.

Example 2. In the Latitude of 42d. 30m. the Sun's Declination being 12d. 15m. I demand the *Amplitude*?

Ans. The *Ampl.* is 16d. 43m. found as follows; According to the former Directions, for the Latit. of 42d.

and Declin. being $\left\{ \begin{array}{l} 12 \\ 13 \end{array} \right\}$ d. the *Ampl.* is $\left\{ \begin{array}{l} 16. \quad 15m. \\ 17. \quad 37m. \end{array} \right.$
 Subtract, and their Difference is ——— 1d. 22m.
 Then

Then 1
is 15m.
If 60m

Lat. 4
To it ad
Gives A
Again
and L
Subtract
Then
15m. t
If 60

Lat. 4
To it
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Then say, As 1d. or 60m. is to 1d. 22m. or 82m.
so is 15m. to 20m. found as here-under :

If 60m. give ——— 82m. what shall 15 min?

$$\begin{array}{r} 15 \\ \hline 410 \\ 82 \end{array}$$

6(0)123(0)20m: Proportional Part
030 Remainder.

Lat. 42d. and Declin. 12d. the Amplit. is 16d. 15m.
To it add the Proportional Part above ——— od. 20m.

Gives Amplitude for Declin. 12d. 15m. to be 16d. 35m.

Again, for Lat. 43 deg. $\left\{ \begin{array}{l} 12 \\ 13 \end{array} \right\}$ deg. *Amp.* $\left\{ \begin{array}{l} 16d. 31m. \\ 17d. 55m. \end{array} \right.$
and Declin. ——— is ———

Subtracted, makes the Difference to be ——— 1d. 24m.

Then say, As 60m. is to 1d. 24m. or 84m. so is
15m. to 21m. found as here-under :

If 60m. give ——— 84m. ——— what shall 15 min?

$$\begin{array}{r} 15 \\ \hline 420 \\ 84 \end{array}$$

6(0)126(0)21 min. Proportional Parts
00

00 Remainder

D. M.

Lat. 43d. and Declin. 12d. Amplitude is ——— 16 : 31

To it add the Proportional Part above ——— 00 : 21

Gives for Declin. 12d. 15m. the Amplit. ——— 16 : 52

Now because the given Latitude 42d. 30m. is in the
middle, between 42d. and 43d. therefore the Medium
of the Amplitudes before found, is the Amplitude re-
quired, and is thus :

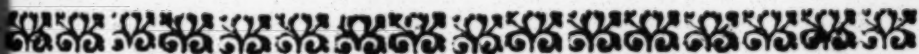
K. 2

Lat.

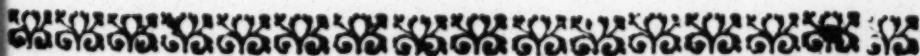
Ex. 2. { True } Ampl. { 07d. 00m. East Northerly,
 { Magnet. } { 15d. 30m. East Southerly,
 I demand the Variation of the Compass ?

By the Rectifier.

Bring 15d. 30m. East Southerly, on the upper Compass, right against 7 deg. East Northerly, on the lower Compass, then the North Point on the first stands against 22d. 30m. North Westerly ; that is, two Points West Variation. In like manner for any other, and the Variation is most readily found. This *RECTIFIER* is made of Wood.



The APPENDIX contains the Description and Use of INSTRUMENTS most useful in Navigation.



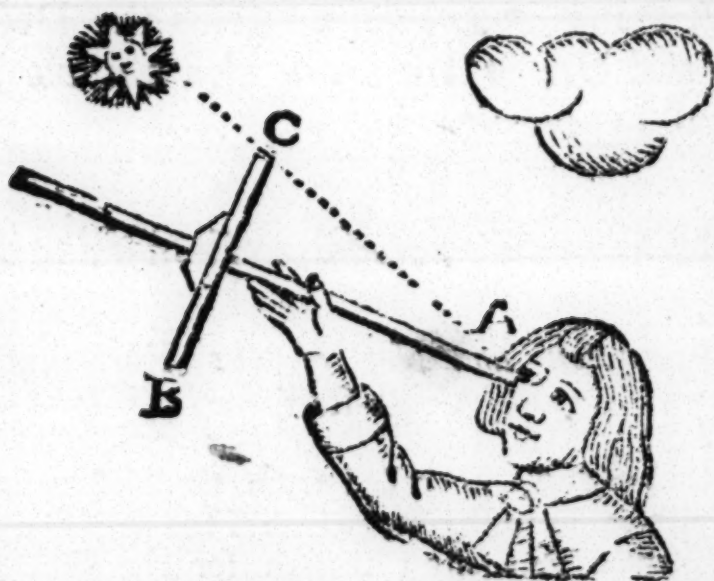
The Description and Use of the Fore-Staff, or Cross-staff.

THE *Fore-staff*, so called from the Posture of the Observer in using it, whose Face is towards the Thing observed generally ; though for the Sun, it's so contrived (for preserving the Eye) to be used backward. It's called also a *Cross-staff* from it's Form ; being a Square Staff with three or four Pieces of Wood across it, which are called *Crosses*.

The Staff is usually about 30 Inches, or 3 Foot long, and more than half an Inch square, having four Sides, each graduated unequally, like a *Scale of Tangents*; To each of them belongs a distinct Cross; though sometimes the shortest Cross is made to serve two Sides of the Staff; that is, the Breadth is for the Ten-Cross, and the Length for the Thirty-Cross. Besides this, it hath two Crosses more, the longest is the Ninety-Cross, the other is the Sixty-Cross. These four Crosses are thus to be understood, *viz.*

$\left. \begin{array}{l} 10 \\ 30 \\ 60 \\ 90 \end{array} \right\}$	Cross, belongs to that	$\left. \begin{array}{l} 4 \\ 10 \\ 20 \\ 30 \end{array} \right\}$	and ending at	$\left. \begin{array}{l} 10 \\ 30 \\ 60 \\ 90 \end{array} \right\}$
	Side beginning at			

The Figure of the *Fore-Staff*.



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The Use of the Fore-Staff.

IT's common and ordinary at Sea, to take the Meridian Altitude of the Sun or Stars with this Instrument, and by it find the Latitude the Ship is in.

To perform which, take Notice of these Precepts following:

1. *Note*, The 10, 30, 60, and 90 Crosss, are to be used according as the Meridian Altitude is more or less; that is, if less than 10d. use the 10 Crosss; if between 10 and 30d. use the 30 Crosss; if between 30 and 60d. the 60 Crosss; if more than 60, use the 90 Crosss.

2. Having considered which Crosss (according to the judg'd Altitude of the Object intended to be observed) is suitable, put it on the Staff, so that the flat Side of the Crosss may be towards the flat or square End of the Staff: Then,

3. Hold the flat end of the Staff (as A) to the corner of your Eye; there let it rest upon your Eye-bone, as near the corner of your Eye as you can, so it doth not hinder your Sight.

4. Then look to the upper End of the Crosss (as at C) for the Sun or Star, and at the lower End (at B) for the Horizon.

5. But if, at the lower End of the Crosss, you see all Sky and no Water, then draw the Crosss a little nearer to your Eye.

6. If, on the contrary, you see all Water and no Sky, then slide the Crosss a little farther from you.

7. Then, if you see the Center of the Sun or Star at the upper End of the Crosss, and the Horizon at the lower End, the Crosss stands as it ought.

8. Wait till the Sun or Star be on the Meridian, making Observation often: And as the Sun or Star riseth, draw the Crosss a little nearer to your Eye.

9. If the Sun or Star be fallen, you will not see the Horizon, for the Water will hide it from you, and then Observing is over at that Time. Stir not the Crosss out of its Place, only see at what deg. &c. it resteth, on that side

of the Staff belonging to it ; and it's the Meridian Altitude or Complement thereof, according to the Word *Alt.* or *Comp.* on the Staff.

How to Use the Fore-staff backward.

THIS is only used with the Sun, and for this Purpose the Ten-Cross hath another Piece of Wood or Ivory put cross it ; so that the lower Edge of this Cross-piece lieth even with the middle of the Square Hole in the Ten-Cross, which also answers to the middle of the Thickness of the Staff.

There is also a Plate of Brass with a Hole in it, and so fitted, that it will slide off and fit the Ends of the 90, 60, or 30 Cross : These two things added to the Fore-staff make it fit for a backward Observation of the Sun, which is thus, *viz.*

1. According as the Meridian Altitude of the Sun, is more or less, so use the 90, 60, or 30 Cross ; putting it on the Staff, the flat Side of it even with the flat End of the Staff, there screw it fast ; and at one End of the Cross slip on the foresaid Brass Plate, so as to leave a slit Sight through it, near the lower End of the Cross.

2. Put the Ten-Cross (having a cross Piece on it) on the Staff, the flat Side of it towards the other Cross at the Staff's End.

3. Turn your Back to the Sun, look through the Slit in the Brass, at the lower End of the Cross, for the Shadow of the upper End of it, lying on the Ten-Cross in the Line answering the middle of the Staff, and on each Side of the Staff.

4. At the same Time the Horizon should be seen (through the foresaid Slit) to lie even with the Shadow on the middle Line, in the Ten-Cross ; and at each End of it, on both Sides the Cross.

5. In looking through the Slit in the Brass, you must bring the Shadow upon the middle Line, and if instead of the Horizon, you see only Water there, Then draw the
Ten-

Ten-Cross nearer, till the Shadow and Horizon agree or meet in the said middle Line.

6. On the contrary, looking as before, if instead of the Horizon you see Sky meet the Shadow on the middle Line; then put the Ten-Cross from you, 'till you see the Horizon and the Shadow meet together on the middle Line.

7. Continue observing till the Sun be at the highest; and as the Sun riseth, you must draw the Ten-Cross nearer, in order to keep the Horizon and Shadow together on the middle of it.

8. If the Sun be fallen (after you have continued observing as before directed) the Horizon will lie below the Shadow on the middle Line; then is the observing finished at that time: Stir not the Ten-Cross out of its Place, for where it now stands (on that Side of the Staff belonging to the Cross at the End of it) is the Sun's Meridional Altitude, or Complement thereof, as before in observing forward.

Thus I have shewed how to take an Observation by the Cross Staff both Forward and Backward. The next Thing in Order, will be to shew how to work it; And for that take notice of these following Rules.

To work an Observation.

1. IF the Sun or Star hath North Declination, and be on the Meridian to the Southward of you, subtract the Declination from the Meridian Altitude; The Remainder is the height of the Equinoctial, or Complement of the Latitude North.

2. But if the Object observed hath South Declination, add; the Sum (if it exceed not 90 deg.) is the Height of the Equator, or Complement of the Latitude North: If the Sum exceed 90 deg. subtract 90 from it; the Remainder is the Latitude South.

3. If the Object hath North Declination, and be on the Meridian to the Northward, add the Declination to

to the Meridian Altitude; the Sum (if it exceed 90 deg.) is the Height of the Equator, or Complement of the Latitude South: But if it doth exceed 90 deg. subtract 90d. from the said Sum, the Remainder is the Latitude North.

4. If the Sun hath South Declination, and be to the Northward at Noon, subtract the Declination from the Meridian Altitude; the Remainder is the Complement of the Latitude South.

5. When the Sun hath no Declination, the Meridian Altitude is the Complement of the Latitude North, if he be South at Noon; and the contrary.

6. If the Sun be in the Zenith, and at the same time he hath no Declination, you are then under the Equinoctial.

7. But if the Sun hath North or South Declination, and in the Zenith, the Declination is the Latitude you are in, North or South.

8. If you observe the Sun or any Star upon the Meridian beneath the Pole, add the Meridian Altitude to the Complement of the Sun or Star's Declination; the Sum is the Height of the Pole, or Latitude of the Place.

These eight Rules are explained by the Examples following.

Examples for working an Observation in North Latitude.

Examp. 1. **A** Dmit at Sea I observe the Sun's Meridian Altitude to be 42d. 20m. South, and at the same Time the Sun's Declination is 10d. 10m. North, I demand the Latitude I am in?

	D.	M.	
The Meridian Altitude	42	20	South
The Sun's Declination	10	10	North
	———— subtract		
The Complement of the Latitude	32	10	
Subtract it from	90	00	
The Latitude I am in, is	57	50	North

Example

Example 2. Being at Sea the 22d of *May*, Anno 1748, I find the Sun's Meridian Altitude to be 65d. 10 min. South; I demand the Latitude?

	D.	M.
The Meridian Altitude	65	: 10 South
The Sun's Declination	Subtract 22	: 17 North
The Complement of the Latitude	42	: 53
Subtract it from	90	: 00
The Latitude I am in, is	47	: 07 North

Example 3. At Sea, the 27 Day of *November*, Anno 1748, I find the Sun's Meridian Altitude to be 26 deg. 30 min. South; I demand the Latitude I am in?

	D.	M.
The Meridian Altitude	26	: 30 South
The Sun's Declination	add 22	: 50 South
The Complement of the Latitude	49	: 20
Subtract it from	90	: 00
The Latitude I am in, is	40	: 40 North

Example 4. At Sea, the 25th of *April*, Anno 1746. I find the Sun's Meridian Altitude by Observation to be 58 deg. 45 min. South; I demand the Latitude I am in?

	D.	M.
Meridian Altitude	58	: 45 South
The Declination	subtract 16	: 34 North
The Complement of the Latitude	42	: 11
Subtract it from	90	: 00
The Latitude I am in, is	47	: 49 North

Example 5. Admit, the 12th Day of *June*, 1749. I find the Sun's Meridian Altitude, by Observation to be 80 deg. 35 min. North; I demand the Latitude I am in?

The

	D.	M.
The Meridian Altitude _____	80	: 35 North
The Sun's Declination _____ add	23	: 28 North
The Sum is _____	104	: 03
From it subtract _____	90	: 00
The Latitude I am in, is _____	14	: 03 North

Example 6. Admit, *August 22, 1746*, the Sun's Meridian Altitude was observed to be 85d. 15m. North; I demand the Latitude of that Place?

	D.	M.
The Meridian Altitude _____	85	: 15 North
The Sun's Declination _____ add	7	: 56 North
The Sum is _____	93	: 11
From it subtract _____	90	: 00
The Latitude of the Place is _____	03	: 11 North

Example 7. Admit, in a Ship at Sea, *June 19, 1746*, the Sun's Meridian Altitude is 66d. 46m. North; I demand the Latitude the Ship is in?

	D.	M.
The Meridian Altitude _____	66	: 46 North
The Sun's Declination _____ add	23	: 13 North
Complement of the Latitude _____	89	: 59
From it subtract _____	90	: 00
The Ship is nearly under the Equinoctial	00	: 01 South

Examples to find the Latitude, by observing the Stars.

Examp. 8. **A**dmit I observe the *Bull's Eye* upon the Meridian, and find his Meridian Altitude to be 50d. 30m. South; I demand the Latitude I am in?
The

	D.	M.	
The Declination of the <i>Bull's Eye</i> is	15	55	North
The Meridian Altitude of the Star	50	30	South
The Star's Declination	subtract 15 : 55		North
Complement of Latitude is	34	35	
Subtract it from	90	00	
The Latitude I am in, is	55	25	North

Example 9. Admit I observe the bright Star in the *Great Dog's Mouth*, and I find his Meridian Altitude to be 35d. 45m. South; I demand the Latitude I am in?

	D.	M.	
The Declin. of the <i>Great Dog's Mouth</i> is	16	21	South
The Meridian Altitude of the Star	35	45	South
The Star's Declination	add 16 : 21		South
The Height of the Equator is	52	06	
Subtract it from	90	00	
The Latitude I am in, is	37	54	North

Examples for working an Observation in South Latitude.

Ex. 10. Admit the 10th Day of *May*, Anno, 1746, I find the Sun's Meridian Altitude, by Observation to be 62d. 00m. North; I demand the Latitude the Ship is in?

	D.	M.	
The Meridian Altitude	62	00	North
The Sun's Declination	add 20 : 13		North
The Complement of the Latitude, is	82	13	
Subtract it from	90	00	
The Latitude the Ship is in, is	07	47	South

Example 11. Admit the 15th Day of *January*, Anno 1747, in Longitude 150d. East, I find the Meridian Altitude, by Observation, to be 58d. 45m. North; I demand the Latitude the Ship is in?

The

The Sun's Declination in the Meridian of *London*, for the 15th of *January* is 18d. 45m. the daily Difference at this Time is 15m. decreasing; therefore (in the Table of Proportion) in *Page 20*, you will find the proportional Minutes to be 6m. which add to the Declination in the Meridian of *London*, the Sum is 18d. 51m. South, the Sun's true Declination for the Longitude of 15od. East.

	D.	M.
The Meridian Altitude	58	: 45 North
The Sun's Declination	subtract 18	: 51 South
Complement of the Latitude, is	39	: 54
Subtract it from	90	: 00

The Latitude the Ship is in, is 50 : 06 South

Example 12. Admit, the 12th Day of *July*, Anno 1748, I find the Sun's Meridian Altitude to be 66 deg. 52 min. North; I demand the Latitude?

The Meridian Altitude	66	: 52 North
The Sun's Declination	add 20	: 01 North
Complement of the Latitude is	86	: 53
Subtract it from	90	: 00

Latitude required, is 03 : 07 South

Example 13. A Ship at Sea, the Sun's Declination being 15d. 30m. South, and the Sun's Meridian Altitude 8od. 45m. South, I demand the Latitude the Ship is in?

Ans. The Latitude is 6d. 15m. South.

Example 14. The Sun's Declination being 11d. 14m. South, and his Meridian Altitude 79d. 38m. South; I demand the Latitude?

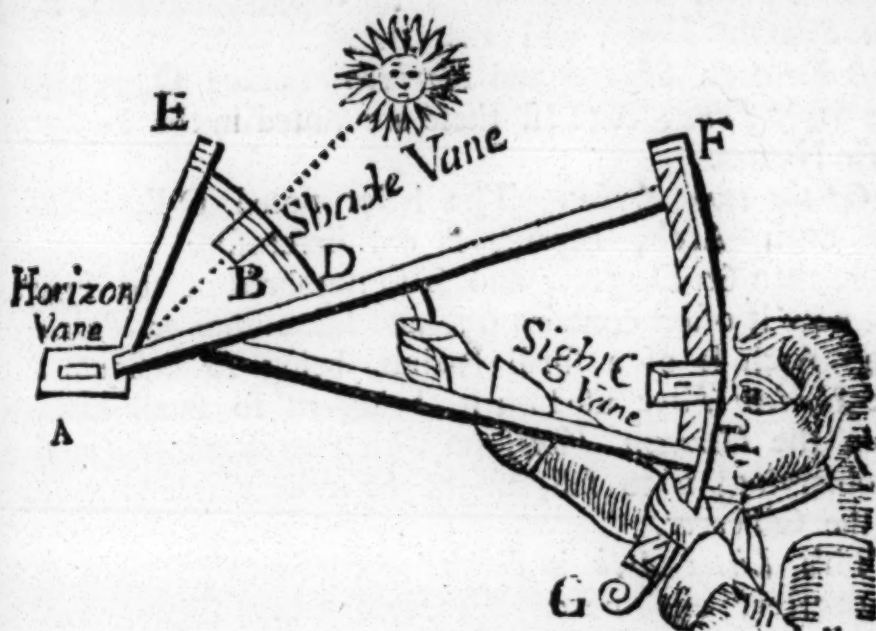
Ans. The Latitude is 0d. 52m. South.

Note 1. If you observe by the lower Part of the Sun, you must add 16m. for the Sun's Semidiameter, and the Sum will be the true Altitude of the Sun's Center.

Note 2. If you observe by the upper Limb of the Sun, subtract 16m. the Remainder is the Altitude of the Sun's Center.

The

The Figure of the QUADRANT.



The Description and Use of the QUADRANT.

THIS Instrument (called a *Quadrant*, first invented by our Countryman Capt. *Davis*, and thence called *Davis's Quadrant*) is of a very commodious Form; at present the most general approved Instrument at Sea, for observing the Sun's Meridian Altitude.

The Form of it (as in the Figure prefixed) may be of any Radius or Length, between 18 Inches and 3 Feet; but the most general now made, are *Quadrants* of 24 Inches Radius, with one Arch 65 degrees, the other 25 degrees, and a Glass in the Shadow Vane.

The principal Parts are three Vanes and two Arches; on which Arches the degrees both together make 90, from whence it hath the Denomination of a *Quadrant*.

The

The *Horizon Vane* (mark'd in the foregoing Figure A, and with its Name) respects the Horizon in Time of observing: That which gives the Shadow marked B, is the *Shadow Vane*; and that through which you are to look for both *Shadow* and *Horizon* marked C, is termed the *Sight Vane*: And all these are noted in the Figure by their Names.

Of the two Arches. The lesser noted D E, is called the 60th Arch, because it did heretofore contain no more than 60 Degrees, and is so numbred in the Figure, but now it often contains 65, and sometimes 70 degrees: This Arch is of a small Radius, being so design'd that the *Shadow Vane* used on it, being at so small Distance from the *Horizon Vane*, on which its Shadow (in time of observing) is to fall, might be more visible to the Eye of the Observer.

This *Little Arch* is divided sometimes but into every 5 degrees, and never less than every single degree: It's numbred from the upper End E, with 0, 5, 10, 15, 20, &c. downwards to D, where it ends in the Line ADF (a Line in the middle of the longer Leg of the *Quadrant*) at 60, 65, or 70 degrees, according as the other Arch is divided; so that the Numbers at D and F together, ever must make 90 degrees.

The *greater Arch*, GF, is called the 30th Arch: it's of a large Radius, that it might contain the lesser Divisions of a degree; and being of a competent Breadth, thereon are usually described 9 *Concentric Circles*, intersected with three Diagonal Lines in each degree, making each Intersection two Minutes of a degree.

The *great Arch* is divided on the Limb into Degrees by long Stroaks, each again subdivided into six equal Parts by shorter Stroaks; each small Division being 10 Minutes, and are numbred from the lower End G, with 5, 10, 15, &c. upwards to F, where it ends in the Line ADF, either at 20, 25, or 30 degrees: The Figures always at F and D together make 90, as in this Figure.

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The Use of the Quadrant.

THIS Instrument is rarely used otherwise than to observe the Sun's Meridian Altitude; which to perform, I thus describe.

1. Put the *Horizon Vane* AB on the End A, and close to the Center A; the *Sight Vane* put on the Arch GF, close to the Back of it; and the *Shadow Vane* put on the little Arch DE, close to the Back of it, and fix the upper Edge of the Vane to a Number of Degrees less than the Complement of the Altitude by 15 or 20 Degrees.

2. The Vanes being thus fixed upon the *Quadrant*, turning your Back towards the Sun, the End G in your Hand, and F uppermost, look thro' the *Sight Vane*, causing the upper Edge of the Shade of the *Shadow Vane* to lie upon the upper Edge of the Slit in the *Horizon Vane*, where is drawn a black Line; at the same time, if the *Horizon* appear thro' the said Slit in the *Horizon Vane*, the Vanes on the *Quadrant* stand at the Sun's present Altitude.

3. But if the *Sky* appear instead of the *Horizon*, slide the *Sight Vane* a little higher towards F; on the contrary, if the *Sea* appear instead of the *Horizon*, then slide the *Sight Vane* lower towards G; continue so to do till the *Horizon* appear thro' the *Horizon Vane*.

4. In order to obtain the Meridian Altitude (which is the greatest Altitude the Sun will have that Day, and the thing used to find the Latitude) continue observing; and as the Sun rises, the *Sea* will appear thro' the *Horizon Vane*; and the *Sight Vane* must be slid lower accordingly: Thus do, observing as often as may be convenient, till the Sun is at the highest.

5. When the Sun begins to fall, the *Sky* will appear (through the *Horizon Vane*) instead of the *Horizon*; then desist observing for that Day.

6. Having thus done, add the degrees the upper Edge of the *Shade Vane* standeth at, to the degrees and min. cut by the Inside of the *Sight Vane*, their Sum is the Complement.

plement of the Sun's Meridian Altitude, or the Distance of the upper Edge of the Sun from the Zenith; to which Sum add 16m. the Sun's Semidiameter, and the last Sum is the Distance of the Sun's Center from the Zenith, being the true Complement of the Sun's Meridian Altitude.

Note, The upper Edge of the Shade of the *Shadow Vane* respects the upper Limb of the Sun. and the lower Edge of the said Shade answers to the lower Limb of the Sun: so that observing by the first, you are to add 16 minutes; On the contrary, observing by the latter, subtract 16 minutes, to, or from what's on the Quadrant, the Sum or Difference is the Distance of the Sun's Center from the Zenith, called his Zenith Distance, or Complement of his Meridian Altitude.

Thus I have shewed how to take an Observation with the Quadrant; I come now to shew how to work it. The Difference in working an Observation taken by the *Fore-staff* and *Quadrant*, is only this; By the *Fore-staff* you take the Altitude, by the Quadrant the Complement of the Altitude, or the Distance of the Sun from the Zenith.

Altitude is the Distance of the Sun from the Horizon; therefore if you subtract the Complement of the *Altitude* from 90d. the Remainder is the *Altitude*; which you may use as in the Use of the *Fore-staff*, in Page 151.

But it's usual to work Observations (made by the Quadrant) by the Complement of the Sun's Meridian Altitude: I will therefore give some general Rules, and some particular Examples for their Explanation.

The general Rules are,

1. **I**F the Sun hath North Declination, and upon the Meridian to the Southward of the Observer, add the Sun's Declination to the Zenith Distance, (or Complement of the Sun's Meridian Altitude) the Sum is the Latitude you are in, North.

2. If the Sun be to the Southward of you, and hath South Declination, subtract the Sun's Declination from the

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the Zenith Distance, the Remainder will be the Latitude you are in, North: But if the Declination exceed the Zenith Distance subtract the less from the greater, and the Remainder is the Latitude, South.

3. If the Sun be to the Northward of you, and hath South Declination, add the Sun's Declination to his Zenith Distance, the Sum will be the Latitude, South.

4. If the Sun be to the Northward of you, and hath North Declination, subtract the Sun's Declination from his Zenith Distance, the Remainder will be the Latitude, South; but if the Declination exceed the Zenith Distance, subtract the less from the greater, and it gives the Latitude, North.

I might have given more general Rules; but if you understand those eight Rules for the Use of the *Forestaff*, you can't err in these, for using the *Quadrant*: And for their Explanation, see the Examples following.

Working an Observation in North Latitude.

Example 1. **O**N the 10th of *April*, 1746, the Sun comes to the Meridian in the South, and by Observation, found his Zenith Distance, or Complement of his Meridian Altitude, to be 34d. 47m. that is, his upper Limb was so much from the Zenith: I demand the Latitude of the Place of Observation?

D. M.

Compl. of the Sun's Meridian Altitude —	34 : 47	South
The Sun's Semidiameter ————— add	00 : 16	
Distance of the Sun's Center from Zenith	35 : 03	South
Declination ————— add	11 : 54	North
Latitude of the Place required, is ———	46 : 57	North

Example 2. The 14th Day of *August*, Anno 1746. I find the Complement of the Sun's Meridian Altitude, by Observation, to be 28d. 48m. South; I demand the Latitude the Ship is in?

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	D.	M.
Comp. of the Sun's Meridian Altitude	— 28	: 48 South
Sun's Semidiameter	— — — — —	add 00 : 16
Distance of the Sun's Center from Zenith	29	: 04 South
The Sun's Declination	— — — — —	add 10 : 47 North
The Latitude the Ship is in, is	— — — — —	39 : 51 North

Example 3. Sept. 13. 1746. I find the Complement of the Sun's Meridian Altitude, by Observation, to be 47d. 35m. South; I demand the Latitude I am in?

	D.	M.
Compl. of the Sun's Meridian Alt.	— 47	: 35 South
Sun's Semidiameter	— — — — —	add 00 : 16
Distance of the Sun's Center from Zenith	47	: 51 South
The Sun's Declination	— — — — —	subtract 00 : 29 South
The Latitude the Ship is in, is	— — — — —	47 : 22 North

Example 4. The 5th Day of November, Anno 1746, I find the Complement of the Sun's Meridian Altitude, by Observation, to be 52d. 00m. South; I demand the Latitude the Ship is in?

	D.	M.
Compl. of the Sun's Meridian Alt.	— 52	: 00 South
Sun's Semidiameter	— — — — —	add 00 : 16
Distance of the Sun's Center from Zenith	52	: 16 South
The Declination of the Sun	— — — — —	subtract 18 : 49 South
Latitude the Ship is in, is	— — — — —	33 : 27 North

Example 5. The 27th of May, 1747, the Sun to the Northward of me, and the Complement of his Meridian Altitude by Observation is 10d. 15m. I demand the Latitude the Ship is in?

	D.	M.
Sun's Declination	— — — — —	22 : 46 North
Complement of Sun's Meridian Altitude	— 10	: 15 North
The Sun's Semidiameter	— — — — —	add 00 : 16
The Sun's true Zenith Distance, subtract	10	: 31 North
Latitude the Ship is in, is	— — — — —	12 : 15 North

Example

Example 6. Admit the 29th Day of *June*, Anno 1748, the Sun upon the Meridian, I find by Observation the upper Limb of the Sun is 6d. 42m. to the Northward of my Zenith ; I demand the Latitude I am in ?

	D. M.
Sun's Declination _____	22 : 13 North
Sun's supreme Marg. Distance from Zen. 06 : 42 North	
Sun's Semidiameter _____ add 00 : 16	
Dist. of Sun's Center from Zenith, subtr. 06 : 58 North	
Latitude the Ship is in, is _____	15 : 15 North

Example 7. The 21st of *July*, Anno 1746, in Longitude 165 deg. West, and the Sun being upon the Meridian, I find by Observation, the supreme Margin of the Sun is 16d. 45m. to the Northward of my Zenith ; I demand the Latitude the Ship is in ?

	D. M.
The Sun's Declination at <i>London</i> _____	18 : 04 North
Proportional min. for Longitude subtract—00 : 07	
Sun's Declination in the Meridian given 17 : 57 North	
Sun's supreme Marg. Dist. from Zenith—16 : 45 North	
Sun's Semidiameter _____ add 00 : 16	
Sun's Central Dist. from the Zenith subtr. 17 : 01 North	
Latitude the Ship is in, is _____	00 : 56 North

Working an Observation in South Latitude.

Example 8. **T**HE 14th Day of *July*, Anno 1749, in Longitude 150 deg. East, and the Sun being upon the Meridian, I find the Complement of his Meridian Altitude, by Observation, to be 48d. 28m. North ; I demand the Latitude the Ship is in ?

	D.	M.
Comp. of the Sun's Meridian Altitude	— 48	: 28 North
Sun's Semidiameter	— — — — —	add 00 : 16
Sun's Central distant from the Zenith	— 48	: 44 North
Sun's Declination for the Longit. subtract	19	: 44 North
The Latitude the Ship is in, is	— — —	29 : 00 South

Example 9. The 25th of October, Anno 1746, in Longitude 120 deg. West, and the Complement of the Sun's Meridian Altitude, by Observation, is 27d. 29m. North; I demand the Latitude the Ship is in?

	D.	M.
Comp. of the Sun's Meridian Altitude	— 27	: 29 North
Sun's Semidiameter	— — — — —	add — 00 : 16
Sun's Central distant from the Zenith	— 27	: 45 North
The Declination of the Sun Prop.—add—	15	: 55 South
The Latitude the Ship is in, is	— — —	43 : 40 South

Example 10. Admit the 24th of December, Anno 1746, I find the Sun upon the South Part of the Meridian, and by Observation the Complement of the Sun's Meridian Altitude 15d. 10m. I demand the Latitude the Ship is in?

	D.	M.
Compl. of the Sun's Meridian Altitude	— 15	: 10 South
Sun's Semidiameter	— — — — —	add 00 : 16
Sun's Central Dist. from the Zenith subtr.	15	: 26 South
The Declination of the Sun	— — —	22 : 46 South
Latitude the Ship is in, is	— — —	07 : 20 South

Thus much I thought necessary to add by way of Explanation upon the foregoing Rules, in Page 161. which shew a perfect Way, by oft Observing; that is, how to take and work an Observation with more Exactness than hath been formerly used.

Note 1.

Note 1. The Sun's Semidiameter, here added to the Complement of its Meridian Altitude, may be placed on the *Quadrant*, that its Addition by the Pen may be omitted. For this Purpose the Quadrants have on the back Edge of the little Arch (every 5 deg. numbred, differing from those on the flat Side) the Semidiameter of the Sun: So that placing the upper Edge of the *Shadow Vane* to the Degree on the foresaid Back Edge of the Arch, the *Quadrant* then sheweth the true Complement of the Altitude, or the Distance of the Sun's Center from the Zenith: which prevents adding 16m. after observing.

Note 2. There is another Contrivance of late, which is putting a Convex Glas in the middle of the Edge of the *Horizon Vane*; which Glas, in time of observing, is to cast an illuminated Spot on a round black Spot made in the *Horizon Vane*: This is useful when the Edge of the Shade of the *Shadow Vane* is not very conspicuous, that being discernable when the latter is not. The manner is thus:

Set that part of the *Shadow Vane*, which is right against the middle or Center of the Glas, to the Degrees on the little Arch, and then cause the enlightned Spot of the Glas to lie on the black Spot or Circle on the *Horizon Vane*; at the same Time look for the Horizon through it, as before directed, in *Page 160*: So you will have (observing by this Glas in the Vane) the true Complement of the Sun's Altitude, or the Distance of his Center from the Zenith.

The Description and Use of the NOCTURNAL.

1. **T**HE *Nocturnal* consists of three Parts; the first termed the Unmoveable Part, is the broadest and greatest; on which is a handle to hold it by, in time of Observation, or using it.

On the fore-side of which, in the outermost Circle, are the 12 Months, and each Month subdivided into its respective Days: They are counted towards the Right-hand, marked with their Names, or the first three Letters thereof; as *Jan.* for *January*, *Feb.* for *February*, *Mar.* for *March*, &c. Within the Circle of Months is a Circle divided into 24 equal Parts or Hours, each Hour divided into Halves and Quarter's; used to find the Time of Full Sea or High-water.

On the Back-side of this Part, are the 32 Points of the *Mariner's Compass*, South uppermost, and East on the Left-hand: To each Point is set the Declination of the North Star, above or under the Pole; which is known by *Und.* for *Under*, and *Abo.* for *Above*.

There has formerly been made two Sorts of *Nocturnals*, one for the *Great Bear*, the other for the *Little Bear*: Those made for the Guards of the *Great Bear*, or *Charles's Wane*, commonly called the *Two Pointers*, have *February* at the Top; but those made for the Guards of the *Little Bear*, have *April* at the Top: But they are now made for both *Bears* in one *Nocturnal*, and are known by having either two Circles of Months, marked GB and LB; or two short Teeth or Indices, proceeding from the second or middle Part of it, mark'd GB and LB: signifying *Great Bear*, or *Little Bear*.

2. The second moveable middle Part hath two Circles on it; the outermost is divided into the 29 Days and a half of the Moon's Age; the innermost is divided into 24 equal Parts or Hours, each Hour subdivided into Halves and Quarters; this Part hath a Tooth, or short Index proceeding from it, with the Edge continued in a Right-line from the Center, which is to be set to the Day of the Month when used: Some have two Indices, marked G on one, and L on the other; G standing for *Great Bear*, and L for *Little Bear*; signifying the *Nocturnal* is made for both *Bears*, and may be used for either.

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3. The third and moveable Part is called the Index ; its uppermost, on the Fore-side of the Instrument, having one Edge proceeding in a Right-line from the Center, which (in Time of Observation) must be turned to the Guards : Through all three Pieces, in the Center of the Instrument, is a Hole, through which you are to see the North Star, when the Index is turned to the Guards.

The Use of the Nocturnal.

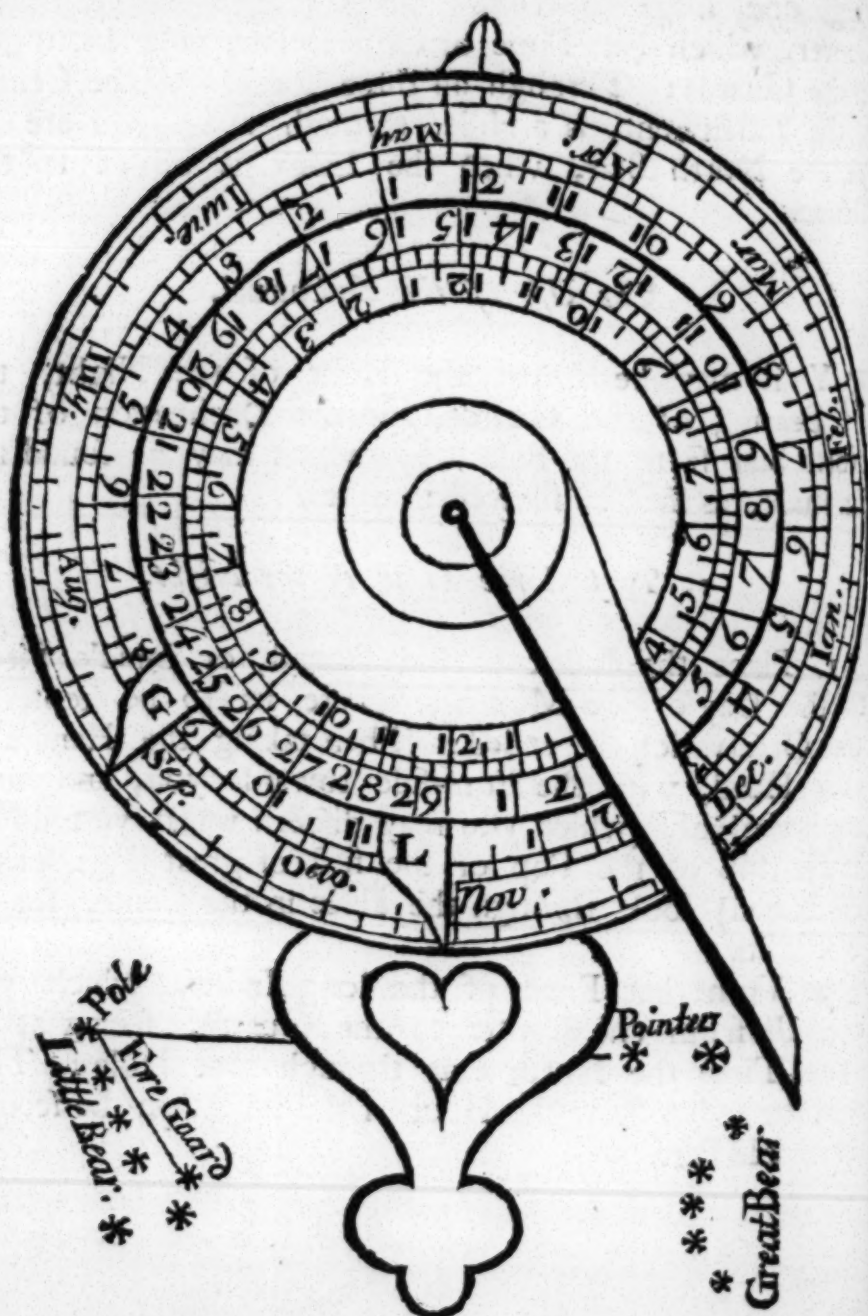
BY it may be found the Hour of the Night, the Bearing of the Guards, and the Declination of the North Star from the Pole ; by which may be found the Latitude, as shall be shewed in order.

1. To find the Hour of the Night.

1. Place the Index of the second, or middle Piece, to the Day of the Month ; where its to be kept, till the Observation is ended : Then taking the Handle in your Hand, with the Fore-side towards you, and holding it upright, (which you may discern when you do so, by the Lip on the Top of the first or great Part of the Nocturnal) look through the Hole in the Center for the North Star.

2. Turn that Edge of the long Index, which proceedeth from the Center to the Guards, seeing at the same Time the North Star through that Hole : Then will the Index shew the Hour of the Night on the second, or middle Part.

The Figure of the NOCTURNAL.



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2. To find the Bearing of the Guards, either of the Little or Great Bear ; that is, upon what Point of the Compass they are, and thereby the North Star's Declination from the Pole.

1. Having observed all the particular Directions as before, in finding the Hour of the Night, you must see the North Star through the Hole, and the Guards by the Edge of the long Index.

2. Then look on the Back-side of the *Nocturnal*, what Point of the Compass standeth against the foresaid Edge of the Index which is the Bearing of the Guards ; and at the said Point of the Compass is figured the North Star's Declination from the Pole at that Time, either above or under.

Example 1. The 20th of *December*, at Six of the Clock in the Morning, observing the Pointers or Guards of the Great Bear by the Edge of the Index : I demand their Bearing, and Declination of the North Star ?

Right against the Edge of that Index you observe with, and on the Back-side of the *Nocturnal*, is S. W. by S. the Point of the Compass required ; and on the said Point of the Compass is 2d. 33m. *und.* signifying the North Star is then 2d. 33m. under the Pole, in the Circle marked *G.B.*

Example 2. The 24th of *February*, I observe (according to the Direction before given) at Seven of the Clock in the Evening, the Guard of the Little Bear by the Edge of the long Index : I demand their Bearing, and Declination of the North Star ?

Seeing the North Star thro' the Hole in the middle, and the Guard of the *Little Bear* by the Edge of the Long Index, (note always that Edge respecting the Center of the Instrument) and the Index cutting Seven of the Clock ; then on the Back-side of the *Nocturnal*, and against the said Edge of the Index, is NE. the Point of their Bearing ; and on the said Point is figured 0d. 35m. *Abo.* which signifieth the North Star is then 35 Minutes above the Pole, in the Circle marked *L. B.*

3. To

3. *To find the Moon's Southing by the Nocturnal.*

To do this, look the Moon's Age in the outermost Circle, on the middle or second Piece of the Nocturnal; and right against it, in the innermost Circle of the same Piece is the Southing.

Example. If the Moon be 19 Days old, I demand her Southing?

Right against 19, in the outermost Circle, is almost $3\frac{1}{2}$ in the innermost Circle; which is half an Hour past Three of the Clock in the Morning nearly, the Time of the Moon's coming to the South.

4. *To find the Time of Full Sea by the Nocturnal.*

1. Set the short Index of the middle Part which stands at 12, to the Time of Full Sea, on the New or Full Moon (for the Place proposed) in the innermost Circle of the great Piece.

2. Keeping that there, bring the long Index to the Moon's (Southing, or) Age, on the middle Piece.

3. Then right against the long Index, and in the innermost Circle on the great Piece, is the Time of Full Sea required.

Example. The Moon being 19 Days old, I demand the Time of Full Sea at Gravesend?

1. Bring the Index of the middle Part (which stands at 12) to $1\frac{1}{2}$ Hour, (which is N. N. E. and S. S. W. the Point of the Compass making Full Sea at *Gravesend*, on the New and Full Moon) in the innermost Circle of 24 Hours on the great Piece, keeping that fast there.

2. Turn the long Index to 19 Days the Moons Age, or to $3\frac{1}{2}$ Hours, the Moon's Southing) on the middle Piece.

3. Then right against the long Index, and in the innermost Circle (on the great Piece) is 5 Hours, the Time of Full Sea, or High-Water in the Morning, at *Gravesend*.

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5. *To find the Latitude by the Nocturnal and Fore-staff.*

1. Find the North Star's Declination from the Pole, by observing with the *Nocturnal*, as directed in *Example 1* and 2, of the second Use, in Page 171.

2. Then (at the same Time) with a Fore-staff, take the Altitude of the North Star.

3. If the North Star be above the Pole, subtract its Declination from (if under, add to) its Altitude: The Sum or Difference, is the Latitude required.

Example 1. Suppose the 14th of *February*, at Seven of the Clock in the Evening, observing with the *Nocturnal*, you find the Guard of the *Little Bear* to bear N.E. which is *od.* 35m. above the Pole; and at the same Time, by the *Fore-staff*, find the Altitude of the *North Star* 42d. 10m. I demand the Latitude of the Place?

	D.	M.
From the Altitude of the North Star	42	10
Subtract its Declination above the Pole	00	35
Remainder is the Latitude required	41	35 North

Example 2. The 20th of *December*, at Six of the Clock in the Morning, observing with the *Nocturnal*, I find the Guards or Pointers of the *Great Bear* S.W. by S. which is 2d. 33m. under the Pole; and at the same Time, by the *Fore-staff*, find the Altitude of the *North Star* 45d. 22m. I demand the Latitude of the Place of Observation?

	D.	M.
To the Altitude of the North Star	45	22
Add its Declination from the Pole under	02	33
Sum is the Latitude required	47	55 North

The Description and Use of Gunter's Scale.

THIS Instrument, for its quick and easy Dispatch of the most common and useful Proportions, deserves

as generally to be known in its Uses, as by its Name; On that Account I'll touch on its Description, before its manifold Uses, as brief and plain as possible.

1. *Gunter's Scale* (so called from Mr. *Gunter*, its first Contriver) is usually made of Box Wood, commonly two Feet long, and one Inch and an half broad; on which are placed the Lines or Scales of Numbers, Sines, Tangents, &c. There are two Sorts, the *Long Gunter*, and the *Sliding Gunter*: On both Sorts are the same Lines, though differently used; the first Sort with the Compasses, the latter by Sliding

2. The Lines (most usual now) set on *Gunter's*, are eight, and have their Names at the Right-hand End thereof, under one another, thus; *Sine Rumb*, *Tang. Rumb*, *Numbers*, *Sines*, *Versed Sines*, *Tangents*, *Meridian* (for Meridional Parts) and *Equal Parts*.

3. The *Sine Rumb*, and *Tang. Rumb*. are both Points of the *Mariner's Compass*; the first is figured from the Left-hand towards the Right, with 1, 2, 3, 4, 5, 6, 7, and 8, at which is a Brass Center-pin; the latter is figured thus, 1, 2, 3, and 4, at the said Center-pin, and thence back again towards the Left-hand with 5, 6, and 7; each Point in both Lines (where it can) is subdivided into Halfs and Quarters: These two Lines are only useful in Navigation.

4. The next under *Tang. Rumb* is the *Line of Numbers*, figured thus; near the Left-hand End it begins at 1, and towards the Right-hand is 2, 3, 4, 5, 6, 7, 8, 9; then 1 in the middle, at which is a Brass Center-pin; going still on, 2, 3, 4, 5, 6, 7, 8, 9, and 10 at the End, where is another Center-pin: This Line is of general Use, and requires the larger Account of it; wherefore take these three following Notes for the *Line of Numbers*.

Note 1. *All the Figures on this Line may be taken single as they stand; or be increased, or diminished at Pleasure, so it be in Decuple or Ten-fold Proportion.* That is, the first 1 may be counted for 1, or 10, or 100, or 1000, &c. then

When the next 2 is accordingly 2, or 20, or 200, or 1000, &c. Again, the first 1 may be reckoned for 1 Tenth, or 1 Hundredth, or for 1 Thousandth Part, &c. When the next 2 is 2 Tenths, or 2 Hundredths, or 2 Thousandth Parts, &c.

So that if the first 1 be esteemed 1, the middle 1 is then 10; and 2 to it's Right-hand is then 20, 3 then is 30, 4 is 40, and 10 at the End is 100. Again, if the first 1 be counted 10, the next 2 is 20, 3 is 30, and 10 on, making the middle 1 now 100; the next 2 is 200, 3 is 300, 4 is 400, and 10 at the End is now 1000.

In like manner, if the first 1 be esteemed for 1 Tenth Part, the next 2 is 2 Tenths, and the middle 1 is now 10; and the next 2 is 20, and 10 at the End is now 100. Again, if the first 1 be counted for 1 hundredth Part, the next 2 is 2 hundredth Parts; the middle 1 is now 10 hundredth Parts, or 1 Tenth Part; and next 2 is 2 Tenth Parts; and 10 at the End, is now but 1 whole Number or Integer.

Note, *As the Figures are increased, or diminished in their Value, so in like manner must all the intermediate Strokes or Subdivisions be increased or decreased:* That is, if the first 1 (at the Left-hand) be counted 1, then 2 (on the Right-hand of it) is 2; and each Subdivision between them now is one tenth Part, and so all the way to the middle 1, which is now 10; the next 2 is 20. Now the longer Strokes between 1 and 2 are to be counted from 1, thus, 11, 12, (where is a Brass pin) then 13, 14, 15, (something a longer Stroke than the rest) then 16, 17, 18, 19, and 20, at the Figure 2: And all the shorter Strokes between these longer are now each to be counted for a tenth Part; from the middle 1 to the next 2, now 20; from whence the longer Strokes between the Figures are Units, thus 21, 22, 23, &c. to 3, which now is 30; and the shorter Strokes between them, each now is two tenth Parts of an Integer; from 3, each short

short Stroke (or little Division) is five tenth Parts of an Unit.

Again, If 1 at the Left-hand be Ten, the Figures between it and the middle 1 are common Tens, and the Subdivisions (between each Figure) are Units, and from the middle 1 to 10 at the End, each Figure is for many Hundreds; and between these Figures, each longer Division are Tens; and from the middle 1 to 2, each less Division is an Unit; from 2 to 3, each less Stroke is two Units; from the Figure 3 to the End, each shorter Stroke is five Units.

Note 3. On the *Line of Numbers* may be counted a Number of any Denomination; whether Measure, as Inches, Feet, Yards, Miles, Leagues, &c. or Weight, as Hundreds, Pounds, Ounces, &c. or Money, as Pounds, Shillings, Pence, &c. or Time, as Years, Months, Days, Hours, &c. provided always the Integer be divided, or supposed to be divided Decimally, or into Tens.

5. Next under Numbers is the *Line of Sines*, beginning at the Left-hand, and figured thus; 1, 2, 3, &c. to 10; then 10, 30, 40, &c. to 90, ending at the Right-hand, where is a Brass Center Pin: These Figures never change their Value or Denomination, being here (and in all other Lines under it) called Degrees.

From the Beginning of this Line to 10 Degrees, each Degree is divided into 12 Parts, by longer and shorter Strokes, making each 5 Minutes; from 10 Degrees to 20, each smaller Stroke is 10 Minutes; from 20 to 30 Degrees, each is fifteen Minutes; from thence to 60 Degrees, some are twenty, but the most are thirty Minutes; and from 60 to 80 Degrees, each Division is a Degree: 80 and 90 are so near together, that it admits but of one Stroke between, which is for 85 Degrees.

6. Next to the *Line of Sines* is the *Versed Sines*, beginning at the Right-hand against 90, (in the *Sines*) and from thence figured towards the Left-hand thus,

thus, 10, 20, 30, 40, &c. ending (at the Left-hand End) about 169 Degrees; the Subdivisions are thus, from 10 to 30, each is 2 Degrees; from thence to 90, it's single Degrees; from thence to 120 it's half Degrees; and from thence to the End, it's divided into each 15 Minutes.

7. Under *Versed Sine* is the *Line of Tangents*, beginning at the Left-end, as the *Sines* do; from thence figured to the Right-hand, thus, 1, 2, 3, &c. to 10; and so on, 20, 30, 40, and 45 at the Right-hand, where is a little Brass Center-pin, just under and even with 90 in the *Sines*; from thence back again it is figured 50, 60, 70, 80, &c. to 89; ending at the Left hand End, where it began at 1 Degree: The Subdivisions of this Line are like those of the *Sines*, so passing that, I proceed;

8. Next to the *Tangents* (and under it) is the *Line of Meridional Parts*, beginning at the Right-hand, and is figured thus, 10, 20, 30, &c. to the Left-hand, where it ends at 87 Degrees: This Line, with the Line of equal Parts under it, are used together only in *Mercator's Sailing*; the uppermost Line contains the Degrees of the Meridian or Latitude in a Mercator's Chart, and the lower is the Equinoctial, and contains the Degrees of Longitude.

9. These eight Lines thus described, are set on the *Sliding Gunter*, but not in the same Order, being some on one side, and some on t'other: Also the Line of Numbers, Sines, and Tangents, are set double, that is, one on each side, as the middle Piece slides; which middle Piece is so contrived, to slip to and fro easily, to slide out, and to be put in, any Side uppermost, in order to bring those Lines together (or against one another) most proper for solving the Question wrought by the *Sliding Gunter*: Of which this short Description may suffice.

I. The Use of Gunter's Scale, both single and sliding, in Arithmetic.

IN order to a right Understanding of the Use of this Scale, it's necessary to number well on it; that is, to find readily a Place representing any given Number, and that chiefly on the Line of Numbers; which is as follows.

PROBLEM I. *To find a whole Number on the Line of Numbers.*

Rule 1. **L**OOK the first Figure of the given Number among the figured Divisions.

2. For the second Figure count so many Tenths (or longer Strokes) from the figured Division, towards the Right-hand, as are Units in the said second Figure.

3. Then for the third Figure, count from the last Tenth (representing the second Figure) so many lesser Strokes (or Centesms) as that Figure hath Units.

4. In like manner, for the fourth Figure, count from the last Centesim so many Thousands (or lesser Strokes) as are Units in it; and so on, for more Figures; though four Figures, or Thousands, are as many as can well be discerned on a two Foot Gunter.

5. This done, the last Place is the Point where the propounded Number is represented.

Example 1. To find the Point, in the Line of Numbers that doth represent 12?

According to the Rule above, I take the Division at the Figure 1 (in the middle of the Line of Numbers) for the first Figure of 12, the propounded Number: then for 2, the second Figure, I count two Tenths (or longer Strokes to the Right-hand, from the said Stroke at 1; and this last is the Point representing 12, where (most commonly) is a small Brass Center-pin, being oft in Use.

Example

Example 2. Suppose the Point representing 22, on the Line of Numbers, was required to be found?

The first figure in the Number 22 being 2, I take the Division at the Figure 2 for it; and for the second Figure being 2, I count 2 Tenths onwards; and that is the Point representing 22.

Example 3. I desire to know the Point, on the Line of Numbers, that doth represent 144.

The first Figure being 1, I take the Division at the middle 1 for it; the second Figure being 4, I count 4 Tenths onwards, and that is 140; from thence count 4 Centesms farther, for the third and last Figure: This last Place is the Point representing 144.

Example 4. Let it be required to find, on the Line of Numbers, the Point representing 1728.

For the first Figure 1, take the middle 1; for the second Figure 7, count as before, onward, 7 Tenths, and that is 1700; then for 2, the third Figure, count 2 Centesms from the last, and it represents 1720; lastly, for the fourth Figure 8, estimate 8 thousand Parts from the last; This Point last found, representeth 1728.

PROB. II. *To find a Fraction, or broken Number, on the Line of Numbers.*

THE Fractions to be found on this Line must always be Decimal; as these, 1, 01, 001; 2, 02, 002, &c. that is, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$; $\frac{2}{10}$, $\frac{2}{100}$, $\frac{2}{1000}$, &c. either of Inches, Feet, Yards, Miles, or the like; also in Weight, or Time, or any other Denomination whatsoever.

So that all other Fractions must be reduced into Decimals, before they can be found on the Line of Numbers; and being so reduced, they are expressed and found upon this Line as whole Numbers, by the Rule in *Problem I.* and needs no Example.

PROB. III. *To perform Multiplication by the Line of Numbers.*

The Rule is;

AS 1 is to the Multiplier, so is the Multiplicand to the Product.

Now to work this, or any Proportion on the Gunter, this is a General Rule.

1. Extend the Compasses from the first Term to the second Term.

2. That Extent (in the Compasses) laid the same way from the third Term, will reach to the fourth Term, or Thing required.

By the Sliding Gunter, thus;

1. Set the first Term, counted on the Sliding or middle Piece, right against the second Term, counted on the fixed Piece.

2. Then seek the third Term, (always on the same Piece the first Term was counted) and against it on the other Part is the fourth Term, or Thing required.

Example 1. What is the Product of 8, multiplied by 4?

The Analogy or Proportion is this: As 1 is to 4, so is 8 to the Product.

Or, it is thus: As 1 is to 8, so is 4 to the Product.

1. *By the Gunter with Compasses, thus;*

Extend the Compasses from 1 to 4; the Extent laid from 8 (the same way) reacheth to 32, the Product of 8 multiplied by 4.

Or, the Extent from 1 to 8, being laid from 4, reacheth to 32, the Product as before.

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2. By the *sliding Gunter*, thus ;

Set 1, at the beginning of the middle or sliding Piece, right against 4 on the fixed or outside Piece ; then against 8 on the first, is 32 on the second, the Product required.

Or set (as before) 1 against 8 ; then against 4 on the first is 32 on the second, the Product as before.

Example 2. What is the Product of 16, multiplied by 5 ?

The Proportion to work it by, is this: As 1 is to 5, so is 16 to the Product.

1. By *Gunter with Compasses*, it's thus ;

The Extent from 1 to 5 being laid from 16, reacheth to 80, the Product required.

2. By the *Sliding Gunter*, thus ;

Set 1 on the middle Piece, against 5 on the outside Piece ; then against 16 on the first is 80 on the second, the Product as before.

PROB. IV. *To perform Division by the Line of Numbers.*

The Rule or Proportion is this ;

AS the Divisor is to 1, so is the Dividend to the Quotient.

Example 1. If the Dividend be 64, and the Divisor 4, What is the Quotient ?

To do this, the Proportion is ; As 4 is to 1, so is 64 to the Quotient required.

1. By *Gunter with Compasses*, thus ;

The Extent from 4 to 1, laid (the same way) from 64, reacheth to 16, the Quotient required.

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2. By the *sliding Gunter*, thus ;

Set 4 on the outside Piece, against 1 on the middle Piece ; then against 64 on the first, is 16 on the second ; which is the Quotient as before.

Example 2. How often is 144 contained in 1728 ?

To do this, the Proportion is thus ; As 144 is to 1, so is 1728 to the Answer.

1. By *Gunter with Compasses*, thus ;

The Extent from 144 to 1, reacheth from 1728 to 12, the Quotient and Answer required.

2. By the *Sliding Gunter*, thus ;

Set 144 on the outside Piece, against 1 on the middle Piece ; then against 1728 on the first, is 12 on the second, which is the Quotient as above.

P R O B. V. *To reduce a Vulgar Fraction to a Decimal, by the Line of Numbers.*

To perform this, the Proportion is thus ;

AS the Denominator (of the given Fraction) is to it's Numerator, so is 1 to the Decimal Fraction required.

Example. Suppose it be required to reduce $\frac{3}{4}$ (a Vulgar Fraction) into a Decimal Fraction ?

Note, A Decimal Fraction hath for its Denominator an Unit, with as many Cyphers as its Numerator hath Places ; and the Proportion to find its Numerator is thus ; As 4 is to 3, so is 1 to the Numerator of the Decimal Fraction required.

1. By *Gunter with Compasses*, thus ;

The Extent from 4 to 3, reacheth (the same way) from 1 to 75, or 750, the Decimal Fraction required.

2. By

2. By *sliding Gunter*, thus;

Set 4 on the outside Piece, against 3 on the middle Piece; then against 1 on the first is .75, or $\frac{3}{4}$ on the second, the Decimal Fraction required to be found: So that .75, or $\frac{3}{4}$, is equal in Value to $\frac{3}{4}$.

PROB. VI. *Of continual Proportion, or Geometric Progression; which is unto two given Numbers, To find a 3d, 4th, 5th, &c. Numbers, in a continual Proportion, by the Line of Numbers.*

The Analogy by which it is effected, is this;

AS the first given Number is to the second, so is the second to the third; and so is that third to a fourth, and so is that fourth to a fifth, &c.

Example. Let the two Numbers given be 2 and 4, unto which it's required to find a third, a fourth Proportional, &c.

For the Performance hereof, the Rule is thus:

As 2 is to 4, so is 4 to a third, and so is that third to a fourth, &c.

1. By *Gunter with Compasses*, thus:

The Extent from 2 to 4 reaches from 4 to 8, the third; and from 8 to 16, the fourth; and from 16 to 32, the fifth Proportional Number; and so on, to as many as you please: So that 2, 4, 8, 16, 32, &c. are Numbers in continued Proportion Geometric, as was required.

2. By *sliding Gunter*, thus;

Set 2 on the middle Piece, to 4 on the outside Piece; then against 4 on the first, is 8 on the second, for the third Proportional; and against 8 on the first, is 16 on the second, the fourth Proportional; and in like manner against 16 is 32, the fifth Proportional, as was required: And so on for more.

M 4

PROB.

PROB. VII. *Of the Rule of Three Direct, three Numbers given to find a fourth in a direct Proportion, by the Line of Numbers.*

The Analogy whereby this is performed, is thus,

As the first Number is to the second, so is the third to the fourth Number required.

Example 1. If the Diameter of a Circle be 7 Inches, and the Circumference thereof 22, what is the Circumference of a Circle, whose Diameter is 14 Inches?

To perform this, the Analogy is thus: As 7 is to 22, so is 14 to the Circumference required.

1. *By Gunter with Compasses, thus,*

The Extent from 7 to 22, laid (the same way) from 14, will reach to 44, the Circumference of the Circle, whose Diameter is 14; which was required.

1. *By the Sliding Gunter thus;*

Set 7 on the middle Piece, against 22 on the outside Piece; then against 14 on the first, is 22 on the second, which is the Circumference as above.

Example 2. If the Circumference of a Circle be $3\frac{14}{8}$ or $3\frac{1}{8}$, and its Diameter 1; what will the Diameter of another Circle be, whose Circumference is 44?

The Proportion is: As $3\frac{1}{8}$ is to 1, so is 44 to the Diameter required.

1. *By Gunter with Compasses, thus;*

The Extent from $3\frac{1}{8}$ to 1, reacheth from 44 to 14, the Diameter required.

2. *By the sliding Gunter thus;*

Set $3\frac{1}{8}$ on the outside Piece, right against 1 on the middle Piece; and then against 44 on the first, is 14 on the second, which is the Diameter required, as above.

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Note, In the *Rule of Three Direct*, if the third Number be greater than the first, then will the fourth Number be greater than the second : But if the third Number be less than the first, then the fourth will be less than the second.

Example 3. If 30 Acres of Land be worth 25 Pounds a Year ; how much a Year will 54 Acres be worth ?

To do this, or any Question in the *Rule of Three*, always in the Proportion, let the first and third Numbers or Terms be of one Kind or Denomination ; and then thus it is : As 30 Acres is to 25 Pounds, so is 54 Acres to 45 Pounds.

1. By *Gunter with Compasses*, thus.

The Extent from 30 to 25, reacheth from 54 to 45, the yearly Rent required.

2. By the *Sliding Rule*, it's thus ;

Set 30 against 25, then against 54 on the first is 45 on the second, as before.

By this Time the Reader is so well acquainted in the way of working a Proportion on the Line of Numbers, with Compasses or without, that it's a needless Thing to express it in Words, being ever the same : Henceforward you shall have only the Proportion set down, leaving the manner of its Operation to your Practice, except in Cases where the working differs from what went before.

P R O B. VIII. *Of the Rule of Proportion Inverse, or Three Numbers given to find a fourth in an Inverse Proportion, or in the backward Rule of Three, by the Line of Numbers.*

1. **I**N this Rule you must note, If the third Number be greater than the first, then will the fourth be less than the second : But,

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If the third be less than the first, the fourth is to be greater than the second.

3. And to resolve Questions of the backward Rule of Three, the Proportion is thus :

As the third Number is to the second, so is the first to the fourth.

Example If 72 Pioneers make a Trench in 48 Hours, in how long time will 54 Pioneers make it ?

By the Directions above, this is the Proportion : As 54 Men is to 48 Hours, so is 72 Men to 64 Hours, the Answer to the Question : From whence you may conclude that 54 Men will perform as much in 64 Hours, as 72 Men in 48 Hours.

PROB. IX. *Of Duplicate Proportion, or Three Numbers given to find a fourth in a Duplicate Proportion, by the Line of Numbers.*

THIS Rule is chiefly used in Proportion of Lines to Superficies, &c. wherein the first and second Terms are to be of one Kind or Denomination.

Example 1. If the Diameter of a Circle be 1, and its Area or Content 0.78539; what's the Content of a Circle, whose Diameter is 14 ?

To perform this, the first and second Terms (by the Note above) are to be Lines; that is, the Diameters given, and then the Proportion is thus : As 1 is to 14, so is 0.785 to a fourth : and so is that fourth to the Content required.

1. By *Gunter with Compasses*, it's thus ;

The Extent from 1 to 14 reacheth from 0.785 to 11; and the same Extent laid the same way from 11, reacheth to 154, the Content required.

2. By

2. By the *sliding Gunter*, it's thus ;

Bring 1 on the middle Piece, right against 14 on the outside Piece ; then against 0.785 on the first, is 11 on the second ; and against 11 on the first, is 154 on the second, the Content as before.

Example 2. If the Diameter of a Circle be 7, and its Area 38.5 ; what is the Area of a Circle, whose Diameter is 12 ? *Answer* 113. For,

As 7 is to 12, so is 38.5 to 66 ; and so is 66 to 113, the Area required.

Example 3. If the Diameter of a Circle be 1, and its Area 0.78539 ; what is the Diameter of a Circle, whose Area is 154 ? *Answer*, 14 is its Diameter.

In this the Proportion is of Superficies to Lines, which is thus : As Area 0.785 is to Area 154, so is square of Diameter 1, to Square of Diameter required.

1. By *Gunter with Compasses*, it's thus ;

The Extent from 0.785 to 154, reacheth from 1 to 196, the Square of the Diameter required.

Then divide the Space between 1 (always the middle 1, if the Number of Places be odd ; but if even, the first 1) and 196 into two equal Parts ; the Foot of the Compasses in the middle resteth at 14, the Diameter of the Circle, whose Area is 154.

2. By the *sliding Gunter*, it's thus ;

Set 0.785 against 154, and against 1 on the first, is 196 on the second ; then find the middle between 1 and 196, which is at 14, the Diameter as before.

Example 4. The Diameter of a Circle being 1, and its Area 0.785 ; what is the Diameter of a Circle whose Area is 113 ? *Answer*, 12 is the Diameter required.

For as 0.785 is to 113, so is 1 to 144 ; the middle between it and 1 is at 12, the Diameter required.

P R O B.

PROB. X. *Of Triplicate Proportion, or Three Numbers given, to find a fourth in a triplicate Proportion, by the Line of Numbers.*

THIS Problem concerneth the Proportion of Lines to Solids, and the contrary; in which evermore make the first and second Term to be of one Denomination.

Example 1. If an Iron Bullet weigh 9 Pounds, and its Diameter is 4 Inches, what is the Weight of another Iron Bullet whose Diameter is 6 Inches?

To perform this, the first and second Terms are to be Lines, that is, the given Diameters; and then the Proportion is thus:

As 4 is to 6, so is 9 to 13.5; and so is 13.5 to 20.2; and so is 20.2 to 30.3; that is, 30 Pounds and 3 Tenths of a Pound, which is the Weight required.

That is, 1. By *Gunter with Compasses*, thus;

The Extent from 4 to 6 being laid 3 times from 9, will reach to 30 Pounds 3 Tenths, the Weight required.

And, 2. By the *Sliding Gunter*, it's thus;

Set 4 against 6, and against 9 on the first is 13.5 on the second; then against 13.5 on the first is 20.2 on the second; and against 20.2 on the first is 30.3 on the second; that is, 30 Pounds 3 Tenths, as before.

Example 2. If an Iron Bullet, 1 Inch Diameter, weigh Pounds 0.1406 Parts; what is the Weight of another, whose Diameter is 14 Inches, it being of the same Metal? *Answer*, 9 Pounds. For,

As 1 is to 4, so is 0.1406 to 0.5624, and is 0.5624 to 2.25; and so is 2.25 to 9 Pounds, the Weight required.

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Example 3. If a Gun 6 Inches Bore require 11 Pound of Powder, how much will serve a Gun 4 Inches Bore?
Answer, Pounds 3.25 Parts.

For, As 6 is to 4, so is 11 to 7.3; and so is 7.3 to 4.88, and so is 4.88 to 3.25; which is Pounds 3.25 Parts of a Pound, or Pounds $3\frac{1}{4}$ of Powder.

Example 4. If an Iron Bullet 1 Inch Diameter, weigh Pounds 0.1406 Parts; what Diameter shall that be, which weigheth 9 Pound of the same Metal?
Answer, 4 Inches.

For it's thns; As 0.1406 is to 9, so is 1 to 64, the Cube of the Diameter required; then divide the Space between 1 and 64 into three equal Parts, and the Foot of the Compasses in the first $\frac{1}{3}$ Part from 1 reacheth to 4, the Diameter of the Iron Shot weighing 9 Pounds.

II. *The Use of the Line of Numbers (commonly called Gunter's Line) in measuring Superficies, as Board, Glas, Land, &c.*

P R O B. I. *The Length and Breadth of any Square, or Long Square Superficies given, to find the Area or Content thereof.*

THE Proportion is this: As 1 is to the Breadth, so is the Length to the Content.

Example 1. A plain Superficies, as a Board or Plank given to be measured, the Breadth thereof is 15 Inches, and it's Length 61 Inches; what is the Content of it?
Answer, 915 Inches.

For, As 1 is to 15, so is 61 to 915 Inches, the Content required.

Note, Such as the Breadth and Length is, such is the Content; so that if the Breadth and Length be Feet, the Content is Feet; if Perches, then Perches, &c.

Example

Example 2. A Piece of Wainscot, in Form of a long Square, whose Length is Feet 15.5 Parts, and Breadth Feet 2.25 Parts; what is the Content? *Answer*, Feet 34.87 Parts. For, As 1 to 2.25, so is 15.5 to 34.87, that is, Feet 34 and 87 Parts is the Content.

PROB. II. *The Breadth and Length of a Superficies given in one kind of Measure, to find the Content thereof in another kind of Measure.*

TO do this, the Proportion is thus: As the required kind of Measure is to the Breadth, so is the Length to the Content desired.

Example 3. A Plank or Board 15 Inches broad, 61 Inches long, I demand the Content of it in Feet? *Ans.* Feet 6.35 Parts of a Foot. For you must note, in a Foot Superficial, or a Square Foot, is 144 square Inches; and therefore the Proportion is thus: As 144 is to 15 Inches, so is 61 Inches to Feet 6.35 Parts of a Foot, the Content.

Example 4. A Piece of Land, in Form a Long Square, whose Breadth being 30 Perches, Length 183 Perches; what is the Content in Acres? *Answer*, Acres 34.31 Parts.

Note, 160 Perches is an Acre, and the Proportion is thus:

As 160 Perches is to 30 Perches, so is 183 Perches to Acres 34.31 Parts of an Acre, the Content of the Piece of Land.

Example 5. A Piece of Painting, in Form a Long Square, whose Breadth is Feet 3.5, and Length 21 Feet, how many Square Yards is the Content? *Answer*, Yards 8.16 Parts of a Yard.

Note, 9 Feet is a Square Yard, and the Proportion is thus:

As 9 is to 3.5 Feet, so is 21 Feet to Yards 8.16 Parts of a Yard, the Content.

PROB.

PROB. III. *The Breadth of a Superficies given in one kind of Measure, and the Length in another; to find the Content in the greater Measure.*

TO do this, the Proportion is thus: As the greater Measure is to the Breadth, so is the Length to the Content required.

Example 6. Admit a Board ten Inches broad, and 20 Feet long, I demand the Content in Feet? *Answer,* Feet 16.6 Tenths of a Foot.

For the Proportion is thus: As 12 is to 10 Inches, so is 20 Feet to Feet 16.6 Tenths.

Example 7. If a Board or Plank be 15 Inches broad, and 27 Feet long, what is the Content of it in Feet? *Answer,* Feet 33.75 Parts of a Foot, or $33\frac{3}{4}$ Feet. For, As 12 is to 15 Inches, so is 27 Feet to Feet 33.75 Parts.

Example 8. A Board $7\frac{1}{2}$ Inches broad, and $29\frac{1}{4}$ Feet long, what's the Content in Feet? *Answer,* Feet 18.28, For it's, As 12 is to $7\frac{1}{2}$, so is $29\frac{1}{4}$ to Feet 18.28 Parts.

Example 9. A Piece of Land (in Form of a Long Square) whose Breadth is 30 Perches, and Length is Chains 15.25 Links, measured by a Chain of 4 Perches in 100 Links) I demand the Content thereof in Acres? *Ans.* Acres 11.44. For it's, As 40 is to 30 Perches, so is Chains 15.25, to Acres 11.44 Parts of an Acre.

PROB. IV. *The Breadth of a Superficies given, to find how much in Length will make a Foot, a Yard, a Perch, or an Acre, &c.*

TO do this, take this General Rule: As the Breadth is to a Foot, a Yard, &c. so is a Foot, a Yard, &c. to that Length which will make a Foot, a Yard, &c.

Example

Example 10. If a Board be $7\frac{1}{2}$ Inches broad, how much in Length will make a Foot square? *Answer,* Inches 19.2 Tenths of an Inch.

For the Proportion is thus: As 7.5 is to 12, so is 12 to Inches 19.2 Tenths in Length, which will make a Foot.

Example 11. A Plank 30 Inches broad, how much in Length will make a Foot? *Answer,* Inches 4.8 Tenths of an Inch.

For, As 30 Inches is to 12, so is 12 Inches 4.8 Tenths in Length, to make a Foot.

Example 12. A Pane of Glass being in Breadth Feet 2.5 Tenths, how much in Length will make a Foot? *Answer,* 4 Tenths of a Foot. For it's thus:

As 2.5 is to 1 Foot, so is 1 Foot to 0.4 Tenths of a Foot in Length, to make a Foot.

Example 13. A Piece of Matting being 27 Inches broad, how much in Length will make a Yard square? *Answer,* 48 Inches, or 4 Feet. For it's thus:

As 27 Inches is to 36 Inches, so is 36 Inches to 48 Inches: But if the Breadth be given in Feet, that is, for 27 Inches, it be $2\frac{1}{4}$ Feet, or 2.25 Feet, then it is thus:

As 2.25 is to 3 Feet, so is 3 Feet to 4 Feet in Length, to make a Yard square.

PROB. V. *The Diameter of a Circle given, to find the Circumference.*

THE Analogy or Proportion is thus: As 1 is to 3.142, so is the Diameter to its Circumference.

Example 14. If the Diameter of a Circle be 15 Inches, what is the Circumference of it? *Answer,* Inches 47.13 Parts of an Inch.

For, As 1 is to 3.142, so is 15 Inches to Inches 47.13 Parts, the Circumference required.

PROB.

PROB. VI. *The Circumference of a Circle given, to find its Diameter.*

THE Proportion is this: As 3.142, is to 1; so is the Circumference, to its Diameter.

Example 15. The Circumference of a Circle being 44 Feet, What is the Diameter thereof? *Answer*, Feet 14. For it's As 3.142, is to 1; so is 44 Feet, to Feet 14 the Diameter,

PROB. VII. *The Diameter of a Circle being given, to find its Area or Superficial Content?*

The Proportion is thus:

AS 1, is to the Diameter; so is 0.7854, to a fourth Number; and so is that fourth Number, to the Superficial Content required.

Example 16. The Diameter of a Circle being 15 Inches, What is the Content of it? *Answer*, Inches 176.7 Tenths.

For it's as 1, is to 15; so is 0.7854, to 11.78; and so is 11.78, to 176.7 the Superficial Content required.

PROB. VIII. *The Circumference of a Circle being given, to find the Superficial Content of it?*

The Proportion is this:

AS 1, is to the Circumference; so is 0.07958, to a fourth Number, and so is that fourth Number, to the Superficial Content required.

Example 17. If the Circumference of a Circle be 44 Inches, What's the Content? *Answer*, Inches 154.06 parts of an Inch. For it's.

As 1, is to 44; so is 0.07958, to 3.5; and so is 3.5, to Inches=154.06 the Content required.

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III. *The Use of the Line of Numbers in Solid Measure, such as Timber, Stone, Gauging, &c.*

PROB. I. *The Side of a Square Solid given in Inches, to find how much in Length will make a Foot Solid?*

THE Proportion is thus: As the given Side is to 12, so is 12 to a fourth Number; and so is that fourth Number to the Length required to make a Foot Solid.

Example 1. A square piece of Timber, or Stone, whose Breadth and Depth, each 8 Inches; how much in Length will make a Foot solid? *Answer* 27 Inches, or 2 Feet 3 Inches: For it's As 8 is to 12, so is 12 to 18? and so is 18 to 27 Inches in Length, to make a Foot.

Example 2. A square Piece of Timber, or Stone, whose side is 2 Feet, or 24 Inches; how much in Length will make a Foot? *Answer* 3 Inches. For it's as 24 is to 12, so is 12 to 6; and so is 6 to 3 Inches in Length, to make a solid Foot.

PROB. II. *The Side of a square Solid given in Foot Measure (that is, the Decimal Foot, or a Foot divided into 100 equal Parts,) to find how much in Length will make a Foot solid.*

THE Proportion is thus: As the given Side is to 1, so is 1 to a fourth Number: and so is that fourth Number to the Length required, to make a Foot solid.

Example 3. A square piece of Timber, whose Side is Feet 1.52 Parts; how much in Length will make a Foot Solid? *Answer*, 0.432 Parts of a Foot. For it's As 1.52 is to 1, so is 1 to 0.658; and so is 0.658 to 0.432 Parts of a Foot.

PROBLEM III. *The Breadth and Depth of a Solid, whose two Ends are equal Long Squares, being given in Inches, or in Foot measure; to find how much in Length will make a Foot Solid?*

1. **T**HE Proportion for Inches is thus: As 12 is to the Breadth, so is the Depth to a fourth Number: Then,

As that fourth Number is to 12, so is 12 to the Length in Inches to make a Foot Solid.

2. The Proportion for Foot measure is thus: As 1 is to the Breadth, so is the Depth to a fourth Number. Then say, As that fourth Number is to 1, so is 1 to the Length in Foot measure, to make a Foot solid.

Example 4. A piece of Timber or Stone, whose Breadth is 11 Inches, and Depth 19 Inches; how much in Length will make a Foot? *Answer,* Inches 8.27 Parts. For, it's as 12 is to 11, so is 19 to 17.4: And then say, as 17.4 is to 12, so is 12 to Inches 8.27 Parts in Length, to make a Foot solid.

Example 5. A piece of Timber, in Breadth Foot 0.75 Parts, and Depth Foot 1.25 Parts; how much in Length will make a Foot solid? *Answer,* Foot 1.06 Parts. For it's as 1 is to 0.75, so is 1.25 to 0.94: Then say, as 0.94 is to 1, so is 1 to Foot 1.06 Parts in Length, to make a Foot solid.

PROB. IV. *The Side of a Square Solid, and its Length being given; to find the Content.*

1. **W**HEN the Side is given in Inches, and Length in Feet, the Proportion is thus. As 12 is to the given Side, so is the Length to a fourth Number; and so is that fourth Number to the Content in Feet.

2. When the Side and Length are both given in Foot measure, the Proportion is thus: As 1 is to the given Side, so is the Length to a fourth Number; and so is that fourth Number to the Content required.

Example 6. A square Piece of Timber, whose Side is 9 Inches, and Length 35 Feet; how many Feet of Timber is in it? *Answer,* Feet 19.68 Parts. For it is,

As 12 is to 9; so is 35, to 26.3; and so is 26.3, to Feet 19.68 Parts, the Content required.

Example 7: A piece of Timber 16 Inches Square, and 28 Feet long, how much is the Content? *Answer,* 50 Feet.

For it's as 12 is to 16, so is 28 to 37.3; and so is 37.3, to 50 Feet, the Content of the Piece of Timber.

Example 8. A Stone, Feet 2.75 Parts Square, and Feet 7.50 Parts long; how much is the Content? *Answer* Feet 56.72 Parts.

For it's as 1 is to 2.75; so is 7.50, to 20.6; and so is 20.6, to Feet 56.72 parts, the Content required.

PROB. V. *The Length, Breadth, and Depth of a Square Solid being given, to find the Solid Content?*

1. **I**F the Breadth and Depth be given in Inches, and the Length in Feet, the proportion is thus: As 12 is to the Breadth; so is the Depth to a fourth Number. Then say, As 12 is to that fourth Number, so is the Length in Feet, to the Content in Feet.

2. When the Length, Breadth, and Depth, are all given in Foot Measure, then the Proportion is thus: As 1, is to the Breadth; so is the Depth, to a fourth Number. And then again say, As 1, is to that fourth Number; so is the Length, to the Content in Feet.

Example 9. If a Square piece of Timber be in Breadth 19 Inches, Depth 11 Inches, and 20 Feet long; how much is the Solid Content? *Answer,* Feet 29.03 parts.

For it's thus, As 12, is to 19; so is 11, to 17.4. Then say,

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Example 10. A Stone 20 Inches broad, 13 Inches Deep, and Feet $15\frac{1}{4}$, or $15\frac{25}{80}$ Feet in Length: how much is the Content? *Answer*, Feet 27.5.

For it's: As 12, is to 20: so is 13, to 21.67. And then: As 12, is to 21.67; so is 13.25 to 27.5, that is, $27\frac{1}{2}$ Feet is the Content.

Example 11. A squar'd Piece of Timber, Feet 1.25 broad, Feet 0.56 deep, and 36 Feet long; how much is the Content? *Answer*, Feet 25.20 Parts, or $25\frac{1}{5}$ Feet. For it is,

As 1, is to 1.25; so is 0.56, to 0.7: And then say, As 1, is to 0.7; so is 36, to Feet 25.2 Tenths, the Content required.

PROB. VI. The Diameter of a Cylinder given, to find how much in Length will make a Foot Solid?

1. IF the Diameter be given in Inches, the Proportion is thus: As the given Diameter, is to 13.531: so is 12, to a fourth Number; and so is that fourth Number, to the Length required to make a Foot Solid.

2. When the Diameter is given in Foot measure, the Proportion is thus: As the given Diameter, is to 1.128; so is 1 to a fourth Number; and so is that fourth Number to the Length, which will make a Foot Solid.

Example 12. A round Piece of Timber, or Stone, being 15 Inches Diameter; how much in Length will make a Foot Solid? *Answer*, Inches 9.78 parts of an Inch. For it's,

As 15, is to 13.531; so is 12 to 10.82, and so is 10.82 to Inches 9.76 parts, or $9\frac{26}{80}$ Inches: But supposing the Diameter of the same to be taken in Foot measure, then it's Foot 1.25 Parts. Now how much will make a Foot? *Answer*, Foot 0.81 parts of a Foot.

For it's thus: As 1.25, is to 1.128; so is 1 to 0.902, and so is 0.902, to Foot 0.815 Parts, or $\frac{815}{1000}$ Foot, to make a Solid Foot.

PROB. VII. *The Circumference of a Cylinder given, to find how much in Length will make a Foot solid?*

1. **W**HEN the Circumference is given in Inches, the Proportion is ;

As the Circumference, is to 42.54, so is 12 to a fourth Number ; and so is that fourth Number, to the Length required, to make a Foot solid.

2. But if the Circumference be given in Foot-measure, then the Proportion is ;

As the Circumference is to 3.545, so is 1, to a fourth Number ; and so is that fourth Number, to the Length, to make a Foot solid.

Example 13. If a round Stone or Tree, be 44 Inches about ; how much in Length will make a Foot? *Answer,* Inches 11.22 Parts. For it is,

As 44, is 42.54, so is 12, to 11.6 ; and so is 11.6, to Inches 11.22 parts of an Inch, or $11\frac{2}{5}$ Inches.

But suppose the same was measured by Foot-measure, and the Circumference found to be Feet 3.67 parts ; how much in Length will make a Foot? *Answer,* Foot 0.935 parts. For it is thus ;

As 3.67 is to 3.545, so is 1 to 0.966 ; and so is 0.966 to Foot 0.935 parts, or $\frac{183}{200}$ Foot.

PROB. VIII. *The Diameter and Length of a Cylinder given, to find its solid Content?*

1. **W**HEN the Diameter is given in Inches, and Length in Feet, the Proportion is thus,

As 13.531 is to the Diameter, so is the Length to a 4th Number ; and so is that 4th Number to the Solid Content in Feet.

2. If the Diameter and Length are both given in Foot-measure ; then the Proportion is thus :

As

As 1.128, is to the Diameter, so is the Length to a fourth Number; and so is that fourth Number to the Content required.

Example 14. A round piece of Timber 10 Inches thro', and 30 Feet long. How many Feet of Timber are in it? *Answer,* Feet 16.38 Parts. For it's as 13.531, is to 10, so is 30 to 22.16; and so is 22.16, to Feet 16.38 Parts of a Foot, or $16\frac{38}{100}$ Feet.

But suppose the same Piece measured by Foot Measure, then it's Foot 0.83 Parts through. And the Work is thus:

As 1.128, is to 83; so is 30 to 22.16; and so is 22.16, to Feet 16.38 Parts, or $16\frac{38}{100}$ Feet as before.

PROBLEM IX. *The Circumference and Length of a Cylinder given; to find the Solid Content?*

1. **I**F the Circumference be given in Inches, and Length in Feet, the Proportion is thus: As 42.54, is to the Circumference, so is the Length, to a fourth Number; and so is this fourth Number, to the Solid Content in Feet.

2. When the Circumference and Length are both in Foot Measure, the First Term being 3.545 (instead of 42.54,) the former Words will serve.

Example 15. A round Stone, or Tree, being 30 Inches about, and 25 Feet long: How many Feet solid are in it? *Answer,* Feet 12.43 Parts. For it's thus: As 42.54, is to 30, so is 25, to 17.63; and so is 17.63, to Feet 12.43 Parts, or $12\frac{43}{100}$ Feet.

Now the Compass about being taken in Foot-Measure, is Feet 2.50 Parts. And the Proportion is, As 3.545 is to 2.50, so is 25 to 17.63; and so is 17.63, to Feet 12.43 Parts, or $12\frac{43}{100}$ Feet as before.

Note 1. When Timber tapers; that is, bigger at one End than t'other, it's usual to take the Breadth and Depth in the middle of its Length, and by them to measure the Piece as if it were both Ends of a Bigness.

As $\left\{ \begin{array}{l} 18.95 \\ 17.15 \end{array} \right\}$ is to 25.6; so is 40 to $\left\{ \begin{array}{l} 54 \\ 59.71 \end{array} \right\}$ and so is $\left\{ \begin{array}{l} 54 \\ 59.71 \end{array} \right\}$ to $\left\{ \begin{array}{l} 73 \\ 89.71 \end{array} \right\}$ Beer } Gallons, Wine }

1. By the Gunter with Compasses.

1. The Extent from 1 to 0.7, will reach the same way from 8 to 5.6; which being added to 20, (the Head Diameter) makes 25.6 for the Mean Diameter. Then,

2. The Extent from 18.95 (the Gauge Point for Beer) to 25.6, will reach from 40 to 54; and that Extent turned over again, reaches to 73, the Content in Beer Gallons.

In like manner the Extent from 17.15 (the Gauge Point for Wine) to 25.6, being laid twice from 40, will reach to 89.1, the Wine Gallons.

2. By the sliding Gunter.

1. Set 1 against 0.7, and against 8 on the First, is 5.6 on the Second; which added to 20 (the Head Diameter) makes 25.6 for the Mean Diameter. Then,

2. Set 18.95 (the Gauge Point for Beer) on the First, against 25.6 on the Second; then against 40 on the First, is 54 on the Second; then against 54 on the First is 73 on the Second, the Content in Beer Gallons.

Also, if you set the Gauge Point for Wine 17.15, against the Mean Diameter 25.6, then against the Length of the Cask 40 on the First, on the Second you will find 59.71, and against 59.71 on the First, you'll find on the Second 89.1, the Content in Wine Gallons.

PROBLEM XI. *The Length of a Ship's Keel, and Breadth of the Beam given, to find her Tunnage?*

It's the Practice of Shipwrights about London, to multiply the Length of the Keel, Breadth, and Half-breadth into one another, and to divide the last Product by 94, whose Quotient they count for the Ship's Tunnage: from whence I frame this Proportion following, to be wrought by the Line of Numbers.

1. As

1. As 188, is to the Breadth; so is the Breadth, to a fourth Number: Then say,

2. As 1, is to that fourth Number; so is the Length, to the Tunnage required.

Example 17. Suppose a Ship 72 Feet by the Keel, and 24 Feet by the Beam; I demand her Tunnage? *Answer,* Tuns 220.6 Tenths nearest. See the Work following:

As 188, is to 24; so is 24, to 3.06: And then,
As 1, is to 3.06; so is 72, to Tuns 220.6 Tenths.

1. By the *Gunter* with Compasses.

1. The Extent from the given Number 188, to the Breadth of the Beam 24, will reach from (the said Breadth) 24 to 3.06. Then,

2. The Extent from 1 to 3.06, will reach from the Length of the Keel 72, to Tuns 220.6 Tenths, the Tunnage required.

Or more briefly thus: The Extent from 13.71, (which is the Square Root of the given Number 188) to the Breadth of the Beam 24; being turned over twice from the Length of the Keel 72, reacheth to Tuns 220.6 Tenths as before.

2. By the *sliding Gunter*, thus;

1. Set the given Number 188, against the Breadth of the Ship 24, and against the said Breadth 24, on the First, is 3.06 on the Second. Then,

2. Set 1 against 3.06, and against the Length of the Keel 72 on the First, is Tuns 220.6 Tenths on the Second, as before,

PROBLEM XII. *To find the Tunnage of a Box, Bale or Case, having its Length, Breadth, and Depth given.*

The Rule is thus:

1. **A**S 66, is to the Breadth; so is the Depth, to a fourth Number. Then,

2. As 1, is to that fourth Number; so is the Length, to its Tunnage required.

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Example 18. A Case or Bale being 6 Feet broad, 4 Feet deep, and 10 Feet long, I demand its Tunnage? *Answer,* Tuns 3.63 Parts. For it's thus :

1. By *Gunter's Scale* with Compasses.

1. The Extent from the Given Number 66, to the Breadth 6, reacheth from the Depth 4 to 0.363. Then,

2. The Extent from 1 to the last found Number 0.363, being laid from the Length 10, reacheth to 3.63; that is 3 Tun and 63 Parts of 100, or $3\frac{63}{100}$, Tuns.

2. By the *sliding Gunter*, thus;

1. Set the Given Number 66, against the Breadth of the Bale or Case 6; then against the Depth of it 4 on the First, you will find 0.363 on the Second, a fourth Proportional Number. Then :

2. Set 1 against the said Proportional Number 0.363; then against the Length of the Bale or Case 10 on the First, you will find, on the Second 03.63, or $3\frac{63}{100}$, the Tunnage of the Bale or Case proposed.

Note, That 66 Feet is the Content of a Case that will inclose two *English* Butts, but the Cantlings of them are better than a third part; therefore allowing 26 Feet for the Cantlings, the remaining 40 Feet are counted 1 Tun, And then the Rule is,

1. By *Gunter* with Compasses for the foresaid *Example*;

1. The Extent from the Given Number 40, to the Breadth of the Case or Bale 6, will reach from the Depth 4 to 0.6 a fourth Proportional Number. Then :

2. The Extent from 1, to the said fourth Number 0.6 will reach the same way, from the Length 10, to 6 Tuns, the Content of the Case or Bale required.

2. By the *sliding Gunter*, thus :

1. Set the Given Number 40, against the Breadth of the Bale or Case 6, then against the Depth of it 4, on the First, you will find 0.6 on the Second, a fourth Proportional Number. Then :

2. Set

2. Set 1 against the said Proportional Number 0.6; then against the Length of the Bale or Case 10, on the First, you will find on the Second 6, the Tunnage of the Bale or Case proposed.

PROBLEM XIII. *The Diameter of a Globe given, to find the Solid Content.*

The Rule.

AS 1, is to the Diameter; so is 0.5236, to a fourth Number; and so is that fourth Number, to a fifth; and so is this fifth, to its Solid Content required.

Example 19. A Globe whose Diameter is 8 Inches; What's the Solid Content? *Answer*, Inches 268. For it's wrought thus:

As 1, is to 8; so is 0.5236, to 4.19; and so is 4.19, to 33.5; and so is 33.5, to 268 Inches, the Solid Content of the Globe.

IV. *The Use of the Line of Numbers in Gunnery.*

PROBLEM I. *The Diameter, and Weight of any Piece of Ordnance known; to find the Weight of any other, being of the same Metal and Shape, its Diameter being known.*

Like Solids are in Proportion, as the Cubes of their agreeing Sides. Therefore the Rule is thus:

AS the Diameter of the known Gun, is to the Diameter of the Gun whose Weight is required; so is the Weight of the known Gun, to a fourth Number; and so is that fourth, to a fifth; and so is that fifth, to the Weight required.

Example 1. Suppose a Brass Saker, whose Diameter is Inches 11.5 Tenths, doth weigh 1900 Pounds; What will a Brass Gun weigh, whose Diameter is Inches 8.75 Parts? *Answer*, 837 Pounds. For it's thus:

1. *By Gunter's Scale with Compasses.*

The Extent from the Diameter 11.5 to the Diameter 8.75; being laid three times from the Weight 1900, will reach to 837 Pounds, the Weight of the Gun required. And,

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2. By the *sliding Gunter*, thus :

Set the Diameter 11.5 against the Diameter 8.75 ; then against the Weight 1900 on the First, is 1445 on the Second ; and against 1445 on the First, is 1100 on the Second : Also against 1100 on the First, is 837 Pounds, the Weight required on the Second.

PROBLEM II. *Having the Diameter and Weight of one Piece of Ordnance, and the Diameter of another Piece of another Metal ; to find the Weight of the last, it being of the same Shape with the former ?*

The Rule is thus :

1. **FIND** the Weight of the Piece as if it had been of the same Metal as the propounded Piece, by the last Problem, in Page 204. Then,

2. Consider the Proportions of Metals ; which are these, according to the best Authors ;

Brass	} is to	Iron	} As	9	} is to	8
Lead		Iron		3		2
Lead		Stone		4		1
Iron		Stone		8		3

3. Having the Weights of both Pieces in one sort of Metal, you must then Proportion their Weights according to their different Metals, by the proportionable Numbers of those Metals ; and then it's done.

Example 2. If a Brass Saker of Inches 11.5 Tenths Diameter, weigh 1900 Pound : What will an Iron Gun (of the same Shape) weigh, whose Diameter is Inches 8.75 Parts ?

Answer 744 Pounds. For it's wrought thus :

1. I find by *Prob. 1.* in Page 204, that a Brass piece of Inches 8.75 Parts Diameter, will weigh 837 Pounds ; but because this Piece is Iron, and the Proportion of Brass to Iron (as abovesaid) is as 9 is to 8 : Therefore say,

2. As 9, is to 8 ; so is 837, to 744 Pounds, the weight of the Iron Gun required.

P R O B.

PROBLEM III. By knowing the Allowance of Powder for one Gun; to find how much of the same Powder is requisite for another Gun?

The Rule.

AS the Diameter of the Bore of the Gun whose Allowance is known, is to the Diameter of the Gun whose Allowance is required; so is the Allowance given to a fourth Number; and so is that 4th to a 5th; and so is the 5th to the Allowance required.

But note; Here it's understood, that both Guns are alike fortified; that is, they should have the same Proportion in Weight and Thickness of Metal.

Example 3. If a Saker of Inches 3.5 Tenths Bore require 4 Pound of Powder; what will a Demi-Canon of Inches 6.5 Tenths Bore require? *Answer* Pounds 25.62 Parts. For it's thus:

As 3.5 is to 6.5, so is 4 to 7.44; and so is 7.44 to 13.80; and so is 13.80 to Pounds 25.62 Parts, the Weight of Powder for the Demi-Canon, in Proportion to the given Saker. But suppose the Weight of the Saker 1600; and the Weight of a Demi-Canon 6000; What Allowance of Powder must it then have?

1. By *Problem 1.* Find the Weight of the Demi-Canon in Proportion to the Saker's Weight; which is thus;

As 3.5 is to 6.5, so is 1600 to 2971; and so is 2971 to 5517; and so is 5517 to 10246 Pounds, the Weight of the Demi-Canon, requiring Pounds 25.52 Parts of Powder for its Loading. But seeing its Weight is supposed to be 6000; say,

2. As 10246 is to 6000, so is 25.62 to Pounds 15, the due Allowance of Powder for the Demi-Canon of Inches 6.5 Tenths Bore, weighing 6000 Pounds; at the Rate of a Saker Inches 3.5 Tenths Bore, weighing 1600 Pounds, and requiring 4 Pounds of Powder.

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PROB. IV. *Having the Diameter and Weight of one Bullet, and the Diameter of another of the same Metal given; to find the Weight of the latter?*

The Rule.

THE Weights of Bullets (of the same Metal) are in Triplicate Proportion of their Diameters, and wrought by the Direction in *Problem 10*, of the First Uses of the Gunter, in Page 184 and 185.

Example 4. If an Iron Bullet, 4 Inches Diameter, weigh 9 Pounds; What will an Iron Bullet of 6 Inches Diameter weigh? *Answer*, Pounds 30.4 Tenths. For it is thus;

As 4 is to 6, so is 9 to 13.5 and so is 13.5 to 20.25; and so is 20.25 to Pounds 30.4 Tenths.

PROB. V. *Two Bullets equal in Diameter, but of differing Metal; by the Diameter and Weight of one, to find the Weight of the other.*

The Rule.

AS the Proportion of one Metal, is to the other; so is the Weight of the given Bullet, to the Weight of the Bullet required.

Example 5. Suppose an Iron Bullet, 6 Inches Diameter, weigh Pounds 30.4 Tenths; What will a Stone Bullet of the same Diameter weigh? *Answer*, Pounds 11.36 parts. For it is wrought thus:

By *Problem 2.* of Gunnery, (in Page 205) the Proportion of Iron and Stone is as 8 to 3; therefore say,
As 8 is to 3, so is 30.4 to Pounds 11.39 Parts, the Weight of the Stone Bullet.

PROB.

PROB. VI. *Having the Diameter and Weight of a Bullet of one kind of Metal, and the Diameter of any Bullet of another Metal given; to find the Weight of the latter?*

The RULE.

1. **FIND** the Weight of it (by *Problem 4.*) as if it was the same Metal.

2. Then find it's Weight according to the Proportion of the Metals by the last Problem, and it's done.

Example 6. If an Iron Bullet 4 Inches Diameter, weigh 9 Pounds; What is the Weight of a Leaden Bullet, 6 Inches Diameter? *Answer,* Pounds 45.6 Parts. For it's thus wrought.

1. As 4, is to 6; so is 9, to 13.5; and so is 13.5, to 20.2; and so is 20.2 to Pounds 30.4 Tenths, if it had been Iron: But being it's Lead, say,

2. As 2, is to 3; so is 30.4, to Pounds 45.6 Parts, the Weight being Lead.

V. *The Use of Gunter's Scale in Navigation; and first in Plain-Sailing.*

CASE I.

Course and Distance sailed given, to find the Difference of Latitude and Departure from the Meridian?

To do this, the Proportions are these:

1. **A** S Radius, is to the Distance; so is the Sine of the Course, to the Departure from the Meridian.

2. As Radius, is to the Distance; so is the Sine Complement of the Course, to the Difference of Latitude.

Note; The Radius, according to the Nature of the Proportion, may be any of these.

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And for Conveniency, that each Proportion may stand in one Line.

Let S.	} stand for	{	Sine.
S. c.			Sine Complement.
T.			Tangent.
T. c.			Tangent Complement.
Cr.			Course.
Dist.			Distance sailed.
Diff. Lat.			Difference of Latitude.
Dep.			Departure from the Merid.

Example. If a Ship sails S W. by S. 104 Minutes from Latitude 1d. 45m. North; I demand what Latitude she is in, and her Departure from the Meridian?

As S. 8 P. is to 104 M. so is S. $\left\{ \begin{smallmatrix} 3 \\ 5 \end{smallmatrix} \right\}$ Points, to $\left\{ \begin{smallmatrix} \text{Dep. } 58\text{M.} \\ \text{Diff. Lat. } 86\text{M.} \end{smallmatrix} \right\}$

1. By the *Gunter* with Compasses.

The Extent from 8 Points (on the Line of *Sine Rumbs*) to 104 Min. (on the Line of *Numbers*) will reach the same way from 3 Points (on the Line of *Sine Rumbs*) to 58m. (on the Line of *Numbers*) which is the Departure from the Meridian; and the Compasses kept at the same Distance, will reach (the same way) from 5 Points (on the Line of *Sine Rumbs*) to 86 Minutes, (on the Line of *Numbers*) which is the Difference of Latitude.

Note; The Course is 3 Points, because S W by S. is 3 Points from the Meridian or South; and 5 Points is the Complement of the Course, because S. W. by S. is 5 Points from the Parallel or West: Understand the like any other Course.

O

2. By

2. By the *sliding Gunter*.

Slide 104 min. (on the middle piece) against 8 Points (on the Line of Sine Rumbs on lower outside piece :) then against 3 Points (on the first) is 58 Minutes (on the second) the Departure from the Meridian; and against 5 Points (on the first) is 86 Minutes (on the second) the Difference of Latitude.

	D.	M.	
Latitude sailed from	_____	_____	1 . 45 North
Difference of Latitude 86 minutes, or	_____	_____	1 : 26 South
Subtract, gives the Latitude required	_____	_____	0 : 19 North

C A S E II.

Course and Difference of Latitude given, to find the Distance sailed, and Departure from the Meridian?

To do this, the Proportions are these:

1. As the Sine Comp. of the Course, is to the Difference of Latitude; so is Radius, to the Distance Run.
2. As the Sine Complement of the Course, is to the Difference of Latitude; so is the Sine of the Course, to the Departure from the Meridian.

Example. Suppose a Ship sails NNE. from the Latitude of 2d. 15m. South, and then, by Observation, is in Latitude 1d. 22m. North; What is her Distance sail'd, and Departure from the Meridian?

	D.	M.
Latitude sailed from	_____	2 : 15 South
Latitude by Observation	_____	1 : 22 North
Added, gives the Difference of Latitude	_____	3 : 37 which
reduced into Minutes by multiplying by 60, is		217 Minutes. Then;

As S. 6 Pts. is to 217 M. so is S. $\left\{ \begin{smallmatrix} 8 \\ 2 \end{smallmatrix} \right\}$ Points, to $\left\{ \begin{smallmatrix} 235 \text{ the Dist.} \\ 90 \text{ the Dep.} \end{smallmatrix} \right\}$

C A S E

CASE III.

Course and Departure from the Meridian given; to find the Distance Run, and Difference of Latitude.

This is performed by these Proportions.

1. As the Sine of the Course, is to the Departure from the Meridian; so is Radius, to the Distance sailed.

2. As the Sine of the Course, is to the Departure from the Meridian; so is the Sine Complement of the Course, to the Difference of Latitude.

Example. If a Ship sails S E. by E. from 1d. 10m. North Latitude, till her Departure be 92 Minutes; What is her Distance sailed; and Latitude she is in?

As S. 5 Points, is to 92 M. so is S. $\left\{ \begin{smallmatrix} 8 \\ 3 \end{smallmatrix} \right\}$ Points, to $\left\{ \begin{smallmatrix} 110 \text{ Dist.} \\ 61 \text{ Dif. L.} \end{smallmatrix} \right\}$
D. M.

Latitude sailed from ————— 1 : 10 North

Difference of Latitude 61 Minutes, or ——— 1 : 01 South

Subtract, giveth the Latitude the Ship is in 0 : 09 North

CASE IV.

Distance Run, and Difference of Latitude given; to find the Course, and Departure from the Meridian?

The Proportions are these;

1. As the Distance sailed, is to Radius; so is the Difference of Latitude to the Sine Complement of the Course.

2. As the Radius, is to the Distance sailed; so is the Sine of the Course, to the Departure from the Meridian.

Example. Admit a Ship sails South Westward 98 leag. from the Lizard in 50d. 00m. North Latitude; and then, by Observation, is in 46d. 30m. North Latitude; What is her Course, and Departure from the Meridian,

O 2

d. m.

d. m.

Latitude sailed from _____ 50 : 00 North
 Latitude by Observation _____ 46 : 30 North
 The Difference of Latitude _____ 3 : 30 or 70 leag.

1. As 98 Leagues, is to Sine of 90 Degrees ; so is 70 Leagues to Sine 45d. 30m. whose Complement 44d. 30m. is the Course from the South Westward ; that is, South West nearest. Then,

2. As Sine 90 Degrees, is to 98 Leagues ; so is Sine 44d. 30m. to 68 Leagues, the Departure from the Meridian.

1. By *Gunter* with Compasses.

1. The Extent from 98 leag. (on the Line of Numbers) to 90 Degrees (on the Line of Sines) will reach the same way from 70 leag. (on the Line of Numbers) to 45 deg. 30 minutes (on the Line of Sines ;) which being subtracted from 90 deg. leaves 44 deg. 30 minutes for the Course.

2. The Extent from 90 Degrees (on the Line of Sines) to 98 Leagues (in the Line of Numbers) will reach from 44 deg. 30 min. (on the Line of Sines) to 86 leagues (on the Line of Numbers,) which is the Departure from the Meridian.

2. By the *sliding Gunter*,

1. Bring 98 Leagues (on the Line of Numbers, on the middle piece) against 90 Degrees (on the Line of Sines, on the out-side piece ;) then right. against 70 Leagues) on the First) is 45d. 30 min. (on the Second,) which is the Complement of the Course, and subtracted from 90d. is 44d. 30m. and is near 4 Points from the South towards the West, or South West.

2. And as it now stands, against 44d. 30 min. (in the Line of Sines, on the out-side Piece) is 68 Leagues (in the Line of Numbers, on the middle Piece) which is the Departure from the Meridian.

C A S E V.

Distance Run, and Departure from the Meridian given ; to find the Course and Difference of Latitude. The

The Proportions are as follow.

1. **A**S the Distance sailed, is to Radius ; so is the Departure from the Meridian, to the Sine of the Course.

2. As Radius is to the Distance sailed, so is the Sine Complement of the Course, to the Difference of Latitude.

Example. A Ship runneth 354 Minutes North Eastward, from 1d. 19m. South Latitude, until her Departure from the Meridian be 150 Minutes ; What is her Course, and Latitude she is in ?

1. As 354 Minutes, is to S. 90d. so is 150 Minutes, to Sine 25 deg. the Course North Eastward, or NNE $\frac{1}{4}$ E.

2. As S. 90 degrees, is to 354 Minutes ; so is Sine 65 degrees, to 323 Minutes, the Difference of Latitude.

d. m.

Latitude sailed from is ———— 1 : 19 South

The Difference of Lat. 323 Minutes, or — 5 : 23 North

Subtract, gives the Latitude the Ship is in— 4 : 04 North

CASE VI. *Difference of Latitude, and Departure from the Meridian given ; to find the Course and Distance Run,*

To do this, these are the Proportions.

1. **A**S the Difference of Latitude, is to the Departure from the Meridian ; so is Radius, to the Tangent of the Course.

2. As the Sine of the Course, is to the Departure from the Meridian ; so is Radius, to the Distance sailed.

Example. Sailing between the North and West, from a Port in 1d. 59m. South Latitude, and then arriving at another Port which is in 3d. 8m. North Lat. and is also 209 Minutes to the Westward of the First Port ; I demand the Course and Distance from the First Port to the Second ?

O 3

D. M.

	d.	m.
Latitude of the first Port _____	1	59 South
Latitude of the second Port _____	3	08 North

Added, gives the Difference of Latitude 5 07 or 307m.

1. As 307 min. is to 209 min. so is Tangent 45 deg. to Tang. 34 deg. 15 min. the Course North Westward, or N. W. by N. nearest.

2. As S. 34 degrees 15 minutes, is to 209 minutes; so is S. 90 degrees, to 307 Minutes, the Distance between the two Ports.

1. By *Gunter* with Compasses.

1. The Extent from 307 min. to 209 min. (in the Line of Numbers) will reach from 45 deg. on the Line of Tangents, (that now being the Radius,) to 34 degrees 15 minutes (on the same Line of Tangents) which is the Course from the Meridian.

Note, When the Difference of Latitude is greatest, the Course is less than 45 degrees from the Meridian.

But when the Departure from the Meridian is greatest, the Course is more than 45 deg. from the Meridian.

2. The Second Canon or Proportion for the Distance Run, is wrought as in the second or third Case, in Page 210, or 211.

2. By the *sliding Gunter*.

1. In this Case, so put in the middle piece, that a Tangent Line may slide by and next a Tangent Line, also Numbers against Numbers: Then bring 307 min. (in the Line of Numbers on the middle piece) against 209 min. (in the Line of Numbers on the outside Piece) then against 45 degrees (on the Line of Tangents on the middle Piece) is 34 degrees 15 minutes on the Tangents on the outside Piece, which is the Course required.

2. For the Distance, the manner of working is the same as hath been shewn in Cases First, Second and Third.

Exa
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2. Courf

3. Courf

To Resolve a Traverse by Gunter's Scale.

Example 1. A Ship in 40 degrees North Latitude, and in 5 degrees 24 minutes West Longitude, she sails first S E. by S. 68 minutes, then SW. by W. 55 minutes, and then W N W. 75 minutes : I demand the Course and Distance from the first Place of Departure, and what Latitude and Longitude she is in ?

To do this, First find the Difference of Latitude, and Departure from the Meridian, for each several Course, as directed in *Case 1.* of Plain-Sailing, in Page 208, and 209.

2. Collect the several Differences of Latitude, whether North or South, into one Sum ; and in like manner, the several Departures, either East or West : taking the Difference of the Northing and Southing, for the Difference of Latitude ; and the Difference of the Easting and Westing, for the Departure from the Meridian.

3. Having now the Difference of Latitude, and the Departure from the Meridian known ; the Course and Distance may be found by the Sixth Case of Plain Sailing, in Page 213 and 214.

4. The Difference of Longitude may be found by this Proportion ;

As the Sine Complement of the middle Latitude, is to the Departure from the Meridian ; so is Radius, to the Difference of Longitude. See the Work following.

	M.	Pts.	M.	
1. Course. As S. 8 Points is to 68 ; so is S.		{ 3, to 38		East
		{ 5, to 57		Southing
2. Course. As S. 8 Points is to 55 ; so is S.		{ 5, to 46		West
		{ 3, to 30 $\frac{6}{8}$		S. ing
3. Course. As S. 8 Points is to 75 ; so is S.		{ 6, to 69 $\frac{1}{8}$		W. ing
		{ 2, to 28 $\frac{1}{8}$		N. ing.
				Courses

Courses	Dist.	Diff. Lat.		Departure	
		North	South	East	West
1. S E by S	68		57.0	38.0	
2. SW by W	55		30.6		46.0
3. W N W	57	28.8			69.5
		28.8	87.6	38.0	115.5
			28.8		38.0
		Diff. Lat.	58.8		77.5

Depart.

3. Then ; As min. 58.8, is to min. 77.5 ; so is T. 45 deg. to T. 52d. 50m. the Course from the South towards the West, that is, SW $\frac{1}{4}$ W. almost. And again,

As S. 52d. 50m. is to min. 77.5 ; so is S. 90d. to 97 Minutes, the Distance from the first Place of Departure.

	d.	m.
Latitude sailed from	40	: 00 North
The Diff. of Latitude min 58.8, or	0	: 59 Southerly
Subtract, gives Latit. the Ship is in	39	: 01 North
Therefore the middle Latitude is	39	: 30
Subtracted from	90	: 00
Gives Complement of middle Latitude	50	: 30

4. As S. 50d. 30m. is to m. 77.5 ; so is 90d. to 100m. the Difference of Longitude.

	d.	m.
The Longitude sailed from is	5	: 24 West
The Difference of Longitude 100m. or	1	: 40 West
Added, gives the Longitude the Ship is in	7	: 04 West

Example 2. A Ship in 41d. 30m. North Latitude, and 10d. 20m. East Longitude, sails these several Courses, and Distances, viz. S E by S. 52 Minutes, then S S W.

63 Min.

63 Minutes, E by N. 47 Minutes, N by E half E. 35 Minutes, NNW $\frac{1}{4}$ W. 47 Min. WNW. 73 Min. I demand the Course, and Distance from the first Place of Departure ; also the Latitude and Longitude the Ship is in ?

1. For the doing of which, observe the Work following.

	M.	Points.	M.
1	52	{ 3 }	{ 28.8 E
2	63	{ 2 }	{ 43.2 S
3	47	{ 6 }	{ 24.2 W
4	35	{ 1 }	{ 58.2 S
5	47	{ 7 }	{ 46.2 E
6	73	{ 1 $\frac{1}{2}$ }	{ 9.2 N
		{ 6 $\frac{1}{2}$ }	{ 10.2 E
		{ 2 $\frac{1}{2}$ }	{ 33.6 N
		{ 5 $\frac{1}{2}$ }	{ 20. W
		{ 6 }	{ 42.5 N
		{ 2 }	{ 68. W
			{ 28. N

2. Then to collect the several Northings, Southings, Eastings, and Westings into one ; as here you see in the Table following ; whereby you will have the Difference of Latitude, and Departure from the Meridian.

Courses.	Diff.	Diff Lat.		Departure.	
		North	South	East	West
1. S E by S	52		43.2	28.8	
2. S S W	63		58.2		24.2
3. East by North	47	9.2		46.2	
4. N by E $\frac{1}{2}$ E	35	33.6		10.2	
5. NN W $\frac{1}{4}$ W	47	42.5			20.
6. W N W	73	28.			68.
		113.3	101.4	85.2	112.2
		101.4			85.2
Difference Latitude		11.9		Departure	27.0

3. Now

3. Now having the Difference of Latitude, and Departure from the Meridian known, the Course and Distance is thus found :

As 11.9 minutes, is to 27 minutes; so is T. 45d. to T. 66d. 15m. The Course North Westerly, or W N W, because the North and West Columns are the greatest.

Here observe the Course is more than 45 degrees from the Meridian, because the Departure is more than the Difference of Latitude; according to the Note in the 6th Case of Plain-Sailing, in Page 213. Then for the Distance say,

As 66d. 15m. is to 27 minutes; so is S. 90d. to minutes 29.4: The Distance from the first place of Departing.

	d.	m.
Latitude sailed from	41	30 North
The Difference of Latitude m. 11.9 or	0	12 North
Added, gives the Lat. the Ship is in	41	42 North
And the middle Latitude	41	36
Subtracted from	90	00
Gives Compl. of middle Latitude	48	24

4. Then to find the Difference of Longitude, say :

As S. 48d. 24m. is to 27 min. so is S. 90d. to 36 min. the Difference of Longitude.

	d.	m.
The Longitude sailed from is	10	20 East
The Difference of Longitude 36 min.	0	36 West
Subtract, gives the Longit. the Ship is in	9	44 East

Secondly,

Secondly,

The Latitude

Example

Lizard to

supposed to

Lizard

Barbadoes

The Diff.

m

To answer

1. As the

difference of

the Course.

2. As the

difference of

the two Places

The Meridian

Extend to

the Latitude

Equinoctial

the Line of

Latitude.

Thus, the

13d. 25

deg. 44

the Difference

Secondly, *The Use of the Gunter's Scale in Mercator's Sailing.*

C A S E I.

The Latitude and Longitude of two Places given; To find their Course and Distance.

Example. I demand the Course and Distance from the Lizard to Barbadoes? their Latitudes and Longitudes supposed to be as follow:

	d.	m.		d.	m.
Lizard	50	00	North	5	24
Barbadoes	13	25	North	58	04

The Diff. Lat. — 36 35 South, Diff. Long. 52 40 W
60 60

minutes 2195

minutes 3160

To answer this Question, the Proportions are these;

1. As the Meridional Difference of Latitude, is to the Difference of Longitude; so is Radius, to the Tangent of the Course.

2. As the Sine Complement of the Course, is to the Difference of Latitude; so is Radius, to the Distance of the two Places.

The Meridional Difference of Latitude is thus found:

Extend the Compasses (in the Meridional Line) from the Latitude to the other; that Extent measured on the *Equinoctial Line* (the Line next adjoining to the *Meridional Line* marked EP) gives the Meridional Difference of Latitude.

Thus, the Extent from Latitude 50 Degrees to Latitude 13d. 25m. in the first, being measured on the latter, is 44 $\frac{4}{5}$, or 44d. 24m. or 2664 minutes, The Meridional Difference of Latitude. Then say:

As

As 2664 M. is to 3160 M. } So is T. 45d. to T. 49d. 35m.
 Or, As 44d. $\frac{1}{8}$ is to 52d. $\frac{1}{8}$ }
 the Course from the South Westward, or S W. 4 degrees 35 minutes Westerly. And again :

As S. 40d. 25m. is to 2195m. so is S. 90d. to 3415m.
 Or, As S. 40d. 25m. is to 36d. $\frac{1}{8}$ so is Sine 90d. to 56d. $\frac{1}{8}$, or 56d. 54m. equal to 3414 Minutes.

C A S E II.

Both Latitudes and Course given; to find the Distance, and Difference of Longitude.

The Proportions are these.

1. **A**s the Sine Complement of the Course, is to the Difference of Latitude, &c. as before in the Second Case of Plain Sailing, to find the Distance and Departure from the Meridian, in Page 210.

2. As the Sine Complement of the Middle Latitude, is to the Departure from the Meridian; so is Radius, to the Difference of Longitude.

Or thus; As the Sine Complement of the Course, is to the Meridional Difference of Latitude; so is the Sine of the Course, to the Difference of Longitude.

Example. Admit from the *Lizard* in 50d. 00m. North Latitude, and Longitude 5d. 24m. West, we made (when Leeway, Variation allowed for) our Course to be South 39 deg. Westerly, and then by Observation was in 45d. 1m. North Latitude. I demand her Distance run, and what Longitude she is in?

Latitude sailed from ——— 50d. 00m. North
 Latitude by Observation ——— 45d. 01m. North
 Subtract, is the Diff. of Latitude ——— 4d. 59m. Southerly
 60

Minutes 299

The Middle Latitude is ——— 47d. 30m.
 Subtract from ——— 90d. 00m.
 Compl. of the Middle Latitude ——— 42d. 30m.

As S. 51d. is to 299m. so is S. $\left\{ \begin{smallmatrix} 90 \\ 39 \end{smallmatrix} \right\}$ d. to $\left\{ \begin{smallmatrix} 385 \\ 242 \end{smallmatrix} \right\}$ Dist. Depart.

2. As S. 42d. 30m. is to 242 Minutes ; so is S. 90d. to 358 Minutes the Difference of Longitude. Or thus :
 The Extent from 50d. 00m. on the Meridian Line, to 4d. 01m. measured on the Line of Equal Parts, is 4d. 01m. or 7d. 24m. or 444 Minutes, for the Meridional Difference of Latitude : Then,

As S. 51d. is to 444 Minutes ; so is S. 39 deg. to 358 Minutes. Or thus ;

As 299 Minutes, is to 242 Minutes ; so is 444 Minutes, to 358 Minutes as before, which is the Difference of Longitude.
 D. M.

The Longitude sailed from ——— 5 : 24 West
 The Difference of Longitude 358 min. or ——— 5 : 58 West
 Added, gives the Long. the Ship is in ——— 11 : 22 West

C A S E III.

With Latitudes, and Distance Run given ; to find the Course and Difference of Longitude.

To perform this, the Proportions are these :

1. As the Distance sailed, is to Radius ; so is the Difference of Latitude, to the Sine Complement of the Course, as in the Fourth Case of Plain Sailing, in Page 11, by which Case also you may find the Departure from the Meridian, or Meridian-Distance.

2. As

2. As the Sine Complement of the Middle Latitude, is to the Departure ; so is the Radius, to the difference of Longitude. Or thus ;

As the difference of Latitude, is to the Departure from the Meridian ; so is the Meridional difference of Latitude, to the difference of Longitude.

Example. A Ship in 46d. South Latitude, and 1d. 15m. West Longitude, sails 100 leagues North Eastward, and then by Observation is in Lat. 42d. South ; I demand her Course, Departure from the Meridian, and Long. she is in ?

Latitude sailed from is ——— 46d. South.

Latitude by Observation is ——— 42d. South.

Subtract, give the Diff. Lat. ——— 4d. or 80 leagues

The middle Latitude is ——— 44d. whose Comp. is 46d.

1. As 100 Leag. is to S. 90 deg. so is 80 Leag. to S. 53 deg. 15 min. the Complement of the Course ; so that the Course is 36 deg. 45 min. North Eastward, or NE. by N. $\frac{1}{4}$ E. And then again,

As S. 90d. is to 100 Leag. so is S. 36d. 45m. to 60 Leagues, the Departure from the Meridian.

2. As S. 46d. is to 60 Leag. so is Sine 90d. to 83 leag. the Difference of Longitude, or thus : The Extent from 46d. to 42d. on the Meridional Line, makes 5d. $\frac{5}{10}$ or 110 Leagues on the Equal Parts, which is the Meridional Difference of Latitude. And then it's,

As 80 leag. is to 60 leag. so is 110 leag. to 83 leag. } diff. long.

Or, as 4d. is to 3d. so is 5d. $\frac{5}{10}$ to 4d. $\frac{15}{100}$

Longitude sailed from is ——— 1d. 15m. West

The Difference of Longitude 83 Leag. — 4d. 09m. East

Subtract, gives Longitude Ship is in ——— 2d. 54m. East

C A S E

C A S E IV.

Both Latitudes, and Departure from the Meridian given ;
to find the Course, Distance Run, and Differ. Long.

THE Course, and Distance Run, is found by the
Sixth Case of Plain Sailing, in Page 213.

2. The Difference of Longitude is found as in the
second, third, or fourth Case in *Mercator*.

Example. *A Ship in 33 Degrees North Latitude, and
8 Degrees West Longitude, she sails South Westward un-
till she be departed from the Meridian 58 Leagues, and then
she is in Latitude 28d. 36m. North : I demand her Course,
Distance Run, and what Longitude she is in ?*

d. m.

Latitude sailed from ———— 33 : 00 North

Latitude Ship is in ———— 28 : 36 North

The Difference of Latitude is — 4 : 24 or 88 leagues

The middle Latitude is ———— 30 : 48 Comp. $59^{\circ} 12'$

1. As 88 leagues, is to 58 leagues ; so is T. 45 deg.
T. 33d. 20m. which is the Course South Westerly, or
W. by S.

2. As S. 33d. 20m. is to 58 leagues ; so is S. 90d. to
58 leagues, the Distance sailed.

3. The Meridional Difference of Latitude is 5 deg. $15\frac{1}{2}'$
5 deg. 9 min. or 103 leagues, found as before directed.

4. As $\left\{ \begin{array}{l} \text{S. } 59\text{d. } 12\text{m.} \\ \text{88 leagues} \end{array} \right\}$ is to 58 leagues $\left\{ \begin{array}{l} \text{S. } 90 \text{ deg.} \\ \text{103 leag.} \end{array} \right\}$ to
leagues the difference of Longitude.

5. Longitude sailed from ———— 178 : 00 West

The difference of Longitude 67 leag. or ———— 3 : 21 West

Added, and the Sum is ———— 181 : 21

Which subtract from ———— 360 : 00

Remainder is Longitude the Ship is in — 178 : 39 East

C A S E

C A S E V.

One Latitude, Course and Distance run given; to find the other Latitude, and Difference of Longitude.

1. **T**HE Difference of Latitude, and Departure from the Meridian, is found by the first Case of Plain Sailing, (in Page 208, and 209) and consequently the other Latitude.

2. The Difference of Longitude is found as before in the second or third Case of *Mercator*.

Example. If a Ship sails S E. by S. 120 Leagues, from a Port in 53d. 30m. North Latitude, and 2d. 15m. West Longitude; what Latitude and Longitude is she in?

As S. 8 Points, is to 120 Leagues; so is S. 5 Points, to 100 Leagues, the Difference of Latitude.

And, as S. 8 Points, is to 120 Leagues; so is S. 3 Points, to 76 Leagues, the Departure from the Meridian.

	d.	m.
Latitude sailed from	53	: 30 North
The Diff. of Latitude 100 Leagues, or	5	: 00 South
Subtract, gives the Latitude the Ship is in	48	: 30 North
And the middle Latitude	51	: Comp. 39d
The Meridional Diff. Lat. is 8d. or 160 Leagues.		

As $\left\{ \begin{array}{l} \text{S. } 39^{\text{d.}} \\ 100 \text{ Leag.} \end{array} \right\}$ is to 67 Leag. so is $\left\{ \begin{array}{l} \text{S. } 90^{\text{d.}} \\ 160 \text{ Leag.} \end{array} \right\}$ to 107 Leagues the Difference or Longitude.

	d.	m.
Longitude sailed from is	2	: 15 West
The Diff. Longitude 107 Leagues, or	5	: 21 East
Subtract, gives the Longitude she is in	3	: 06 East

C A S E

C A S E VI.

Sailing in a Parallel, to find the Difference of Longitude.

To do this, the Proportion is thus :

As the Sine Complement of the (Parallel) or Latitude, is to the Distance sailed East or West.

So is Radius to the Difference of Longitude.

Example. If a Ship sails West 390 minutes, in the Latitude of 50d. 10m. and departs from 2d. 45m. East Longitude, I demand what Longitude the Ship is now in?

As S. 39d. 50m. is to 390 min. so is S. 90d. to 610 minutes, the Difference of Longitude.

	d.	m.
Longitude sailed from, is	2	45 East
The Difference of Longit. 610 min. or	10	10 West
Subtract, gives the Longitude the Ship is in	7	25 West

C A S E VII.

The Differ. of Longitude (of two Places in one Parallel or Latitude) given, to find their Distance in that Parallel?

THE Proportion is thus : As Radius is to the Difference of Longitude, so is the Sine Complement of the Latitude, to the Distance in that Parallel.

Example 1. Suppose Cape Vincent in Portugal, and Cape Henry in Virginia, both in 37 deg. North Latitude ; their Longitude supposed to be as here-under, What is their Distance in their Parallel ?

	d.	m.
Cape St. Vincent } Longitude {	10	35 West
Cape Henry } Longitude {	75	02 West

Subtract gives Diff. Longitude 64 : 27 or 3867 minutes

Latitude of both Places is 37 deg. North

Subtract from 90

Remains Complement of the Latitude 53 degrees

P

2. As

2. As S. 90 Degrees, is to S. 53 Degrees; so is $64\frac{4}{5}$ equal to 64d. 27m. to 51d. $\frac{7}{8}$ or 51d. 30m. or 3090m. the Distance required. Or thus:

As S. 90 Degrees, is to S. 53 Degrees; so is 3867 Minutes, 3090m. the Distance in the Parallel as above.

Example 2. Suppose two Ships under the Equinoctial, 100 Leagues asunder, and each sails North till both come into Latitude 60 deg. How far are they now asunder?

Answer, 50 Leagues. For it's thus:

As S. 90 deg. is to S. 30 deg. so is 100 Leagues to 50 Leagues, the Distance required.

C A S E VIII.

To find how many Minutes or Miles make a Degree of Longitude, in any Parallel, or Latitude.

The R U L E.

AS Radius, is to the Sine Complement of the Latitude; so is 60 min. (a Degree in the Equinoctial,) to the Minutes making a Degree of Longitude in the Parallel desired.

Example. In the Latitude of 50 deg. I demand how many Minutes of Easting or Westing make a Degree of Longitude? *Answer,* $38\frac{1}{2}$ Minutes. For it's thus:

As S. 90 deg. is to S. 40 deg. so is 60 min. to min. 38.5 or 38 and an half, to make one Degree of Longitude in Latitude 50 Degrees.

This may be done by the Plain Scale thus:

Take the given Latitude from the Chords, and measure it on the Line M. L. (which is Miles of Longitude) sheweth your desire: As here, take 50 deg. from the Chords, and measure it on the Scale M. L. it sheweth 38 min. and an half as before.

VI. The

VI. Use of Gunter's Scale in Astronomy.

PROBLEM I. *The Sun's Place in the Ecliptic, and his greatest Declination given; to find his Right Ascension and present Declination.*

To perform this, these are the Proportions;

1. **A** S Radius, is to the Sine Complement of the Sun's greatest Declination; so is the Tangent of his Longitude (from the nearest Equinoctial Point,) to the Tangent of his Right Ascension, from the said Point.

The Names and Characters of the 12 Signs.

Aries	} North Signs	♈ Libra	} South Signs
Taurus		♏ Scorpio	
Gemini		♐ Sagittarius	
Cancer		♑ Capricornus	
Leo		♒ Aquarius	
Virgo		♓ Pisces	

Note 1. The Sun's greatest Declination is 23 degrees minutes.

Note 2. The beginning of γ and π are the two Equinoctial Points.

Note 3. This Proportion (above) finds the Sun's Right Ascension only when he is in the first Quarter of the Ecliptic; that is, γ , δ , or π : But when he is in the second Quarter, ϵ , ζ , or η , subtract it from 180 deg. and when in ι , κ , or λ , add it to 180 deg. And when in the last Quarter, ν , ξ , or χ , subtract (what's found in this Operation) from 360 deg. so will you have the Sun's Right Ascension from γ (for any Place in the Ecliptic) desired.

As Radius, is to the Sine of the Sun's Longitude from the nearest Equinoctial Point;) so is the Sine of the Sun's greatest Declination, to the Sine of his present Declination.

Note, The Sun being in Υ , $\varnothing$, Π , $\ominus$, Ω , or $\mathbb{M}$, his Declination is North: But in $\sphericalangle$, $\mathbb{L}$, Z , V , W , or X , it's South.

Example.

When the Sun's Place in the Ecliptick is in $\varnothing$ 24d. 15m. What is his Right Ascension, and Declination?

The Sun being in $\varnothing$, 24 degrees 15 minutes, his Longitude from the nearest Equinoctial Point (being now the beginning of Υ is 54 degrees 15 minutes. And the Complement of his greatest Declination is always 66 degrees 31 minutes. Then it follows:

1. As S. 90 degrees, is to S. 66 degrees 31 minutes; so is T. 54 degrees 15 minutes, to T. 51 degrees 52 minutes, the Sun's Right Ascension (from the beginning of Υ) required.

By Gunter with Compasses.

The Extent from Sine 90 degrees, to Sine 66 deg. 31 min. will reach from Tangent 54 degrees 15 minutes, to Tangent 51 degrees 52 minutes, the Sun's Right Ascension.

By the sliding Gunter.

1. Let the middle Piece be so put in, that Sines may slide against Sines, and Tangents against Tangents.

2. Then bring 90 degrees in Sines (on the outside Piece) against 66 deg. 31 min. in Sines (on the middle Piece) then against 54 deg. 15 min. in Tangents (on the middle Piece) is 51 deg. 52 min. in Tangents (on the outside Piece) the Right Ascension, as above.

This Proportion being to be wrought on Sines and Tangents jointly, I thought it necessary to express the manner of its Operation on both sorts of Gunters, that the Learner might see how it agrees with the General Rule given at the Beginning of this Discourse of the *Gunter*, in Page 177, and 178; but shall wave it in the rest, and only write the Proportions in Words, and in Figures, according to the particular Example, as follows, for the Sun's Declination.

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2. As S. 90 degrees, is to S. 54 deg. 15 min. so is S. 23 deg. 29 min. to S. 18 deg. 52 min. the Sun's Declination North, increasing.

P R O B L E M H.

The Latitude of a Place, and the Sun's Declination given ; to find his Amplitude, and his Ascensional Difference ; and consequently his Rising, or Setting ; and the Length of the Day or Night.

To perform this Problem, the Proportions are these ;

1. **A**S the Sine Complement of the Latitude, is to Radius ; so is the Sine of the Sun's Declination, to the Sine of his Amplitude.

Note, The Amplitude and Declination, are always of one kind ; that is, both North or both South.

2. As Radius is to the Tangent of the Latitude ; so is the Tangent of the Sun's Declination, to the Sine of his Ascensional Difference.

Note 1. The Ascensional Difference (being reduced into Time, by allowing 15 degrees for one Hour, and then) added to, and subtracted from 6 Hours, the one is Sun-rising, the other is Sun-setting.

Note 2. If Latitude and Declination are both North or both South ; the Sun riseth before, and sets after Six of the Clock ; but if one be North, and the other South, the contrary.

Note 3. If the Sun's Rising and Setting be doubled severally, the first is the Length of the Night, and the latter the Length of the Day.

Note 4. By this Problem were the Tables of Amplitudes, and Semidiurnal Arches, &c. in this Book calculated.

Example. Latitude 51 deg. 32 min. North, and the Sun's Declination 23 deg. 29 min. North : I demand his Amplitude, and Ascensional Difference ? Also his Rising, Setting ; length of the Day and Night.

	d.	m.		d.	m.
<i>Ans.</i> Sun's Amplitude	39	: 50	Ascen. Diff.	33	: 10
Sun-setting } is Hours {	8	: 13	Length of Day	16	: 26
Sun-rising } is Hours {	3	: 47	Length of Night	7	: 34

For it's thus ;

1. As S. 38d. 28 min. is to S. 90 deg. so is S. 23 deg. 29 min. to 39 deg. 50 min. the Amplitude North, because the Declination is North, that is, the Sun riseth East 39 deg. 50 min. Northerly, and setteth West 39d. 50m. Northerly.

2. As T. 45 deg. is to T. 51 deg. 32 min. so is T. 23 deg. 29 min. to T. 28 deg. 40 min. against which on Sines is 33 deg. 10 min. the Ascensional Difference ; which being reduced into Time, is 2 hours 13 minutes ; and added to 6 hours, is 8 hours 13 min. for Sun-setting ; which doubled, is 16 degrees 26 minutes, the Length of the Day.

Again, 2 hours 13 minutes subtracted from 6 hours, is 3 hours 47 minutes Sun-rising ; which doubled, is 7 hours 34 minutes, the Length of the Night.

P R O B L E M III.

Latitude of a Place, and the Sun's Declination given ; to find his Altitude and Azimuth at 6 of the Clock.

To solve this, say :

1. **A**S Radius, is to the Sine of the Latitude ; so is the Sine of the Sun's Declination, to the Sine of his Altitude at Six of the Clock.

2. As Radius, is to the Sine of the Complement of the Latitude, so is the Tangent of the Sun's Declination, to the Tangent of his Azimuth (from the East or West) at Six of the Clock.

Note, The Azimuth is from the East, at Six in the Morning ; and from the West, at Six in the Afternoon : Northerly, in North Latitude ; but Southerly, in South Latitude.

Example. In 51d. 32m. North Latitude, the Sun's Declination being 23d. 29m. North : What is his Altitude, and Azimuth at Six of the Clock ?

Ans.

Ans. His Altitude is 18d. 11m. and his Azimuth is East 15d. 07m. Northerly, or 74d. 53m. North Easterly, or Westerly. For it's thus:

1. As S. 90d. is to S. 51d. 32m. so is S. 23d. 29m. to S. 18d. 11m. the Altitude at Six of the Clock.

2. As S. 90d. is to S. 38d. 28m. so is T. 23d. 29m. to T. 15d. 07m. the Azimuth at Six; that is 74d. 53m. North Easterly at six in the Morning, but North Westerly in the Afternoon.

P R O B L E M IV.

Latitude of a Place, and the Sun's Declination given; to find his Altitude, and Hour of the Day, when he is East or West.

To perform this, the Proportions are these:

1. **A**S the Sine of the Latitude, is to Radius; so is the Sine of the Sun's Declination, to the Sine of his Altitude; being East, or West.

2. As Radius, is to the Tangent Complement of the Latitude; so is the Tangent of the Sun's Declination, to the Sine of the Hour from Six of the Clock, when he is East, or West.

Note 1. The Sun is East after Six in the Morning, but West before Six in the Afternoon.

Note 2. The Hour (found by the last Proportion) being reduced into Time (by allowing 15d. to an Hour) and added to, or subtracted from Six, gives the Hour of the Day, when the Sun is East or West.

Example In 51d. 32m. North Latitude, the Sun's Declination being 23d. 29m. North; what is his Altitude? and what time of the Day is it, when he is East, or West?

Ans. His Altitude is 30d. 35m. and the Hour of the Day is { 7h. 21m. Morning, when East.
4h. 30m. Afternoon, when West.

For it's thus;

1. As S. 51d. 32m. is to S. 90d. so is S. 23d. 29m. to S. 30d. 35m. the Sun's Altitude, being either East or West.

2. As T. 45d. is to T. 38d. 28m. so is T. 23d. 29m. to S. 20d. 11m. the Hour from Six, which makes 1 Hour 21 Minutes, added to 6, is 7h. 21m. and subtracted from 6, is 4h. 39m. the former is the Time when the Sun is East in the Morning; the latter the Time when he is West in the Afternoon.

P R O B L E M V.

The Sun in the Equator or Equinoctial (that is, when he hath (no Declination) the Latitude of a Place, and Sun's Altitude given; to find his Azimuth, and Hour of the Day.

This Problem is thus effected.

1. **A** S Radius is to the Tangent of the Latitude, so is the Tangent of the Sun's Altitude; to the Sine Complement of his Azimuth, from the South in North Latitude; but from the North in South Latitude; Easterly in the Forenoon; and Westerly Afternoon.

2. As the Sine of the Complement of the Latitude, is to the Radius; so is the Sine of the Sun's Altitude, to the Sine Complement of the Hour from Noon.

Example. In 51d. 32m. North Latitude, the Sun having no Declination, and his Alt. being 21d. 50m. in the Forenoon; I demand his Azimuth, and the Hour of the Day?

Answ. His Azimuth is South 59d. 45m. Easterly, that is the Sun is upon the S. E. by E. $\frac{1}{4}$ E. Point of the Compass, and the Hour of the Day is Hours 8.33 Minutes Morning. For it's thus:

1. As T. 45d. is to T. 51d. 32m. so is T. 21d. 50m. to S. 30 deg. 15 min. whose Complement is 59 deg. 45 min. is the Sun's Azimuth required.

2. As S. 38 deg. 28 min. is to S. 90 deg. so is S. 21 deg. 50 min. to S. 36 deg. 50 min. whose Complement is 53 deg. 10 min. or 3 Hours 33 Minutes; which subtracted

The Mariner's Compass Rectified.

tracted from 12, gives 8 Hours 27 minutes, or 2
after 8 of the Clock in the Morning, the time of
Day required.

P R O B L E M VI.

*Latitude of a Place, Sun's Declination, and his Altitude
given; to find his Azimuth, and the Hour of the Day.*

The Performance of this, is thus:

TAKE the Complement of the Latitude, the Complement of the Sun's Altitude, and the Sun's distance from the Pole, (which is his Declination added together, when the Latitude and Declination is one North, the other South; but both being either North, or South, the Complement of the Declination) and add them together into one Sum.

2. From half that Sum subtract (to find the Sun's Azimuth) the Sun's Distance from the Pole; but (to find the Hour) the Complement of his Altitude; and note the remainder.

3. *To find the Azimuth, you have these two Proportions following.*

First, As Radius, is to the Sine Complement of the Latitude; so is the Sine Complement of the Altitude, to a fourth Sine. Then again,

Secondly, As that fourth Sine, is to the Sine of the half Sum; so is the Sine of the Remainder, to a fifth Sine; against which, on the Line of Veried Sines, is the Sun's Azimuth from the North in North Latitude; but from the South in South Latitude.

4. *To find the Hour, these are the two Proportions which follow.*

First, As Radius, is to the Sine Complement of the Altitude; so is the Sine of the Sun's Distance from the Pole, to a fourth Sine.

Secondly,

2. As T. 45d. is to T. 38d. 28m. so is T. 23d. 29m. to S. 20d. 11m. the Hour from Six, which makes 1 Hour 21 Minutes, added to 6, is 7h. 21m. and subtracted from 6, is 4h. 39m. the former is the Time when the Sun is East in the Morning; the latter the Time when he is West in the Afternoon.

P R O B L E M V.

The Sun in the Equator or Equinoctial (that is, when he hath no Declination) the Latitude of a Place, and Sun's Altitude given; to find his Azimuth, and Hour of the Day.

This Problem is thus effected.

1. **A** S Radius is to the Tangent of the Latitude, so is the Tangent of the Sun's Altitude; to the Sine Complement of his Azimuth, from the South in North Latitude; but from the North in South Latitude; Easterly in the Forenoon; and Westerly Afternoon.

2. As the Sine of the Complement of the Latitude, is to the Radius; so is the Sine of the Sun's Altitude, to the Sine Complement of the Hour from Noon.

Example. In 51d. 32m. North Latitude, the Sun having no Declination, and his Alt. being 21d. 50m. in the Forenoon; I demand his Azimuth, and the Hour of the Day?

Answ. His Azimuth is South 59d. 45m. Easterly, that is the Sun is upon the S. E. by E. $\frac{1}{4}$ E. Point of the Compass, and the Hour of the Day is Hours 8.33 Minutes Morning. For it's thus:

1. As T. 45d. is to T. 51d. 32m. so is T. 21d. 50m. to S. 30 deg. 15 min. whose Complement is 59 deg. 45 min. is the Sun's Azimuth required.

2. As S. 38 deg. 28 min. is to S. 90 deg. so is S. 21 deg. 50 min. to S. 36 deg. 50 min. whose Complement is 53 deg. 10 min. or 3 Hours 33 Minutes; which subtracted

tracted from 12, gives 8 Hours 27 minutes, or 27 min.
After 8 of the Clock in the Morning, the time of the
Day required.

P R O B L E M VI.

*Latitude of a Place, Sun's Declination, and his Altitude
given ; to find his Azimuth, and the Hour of the Day.*

The Performance of this, is thus :

TAKE the Complement of the Latitude, the Complement of the Sun's Altitude, and the Sun's distance from the Pole, (which is his Declination added to 90d. when the Latitude and Declination is one North, the other South ; but both being either North, or South, the Complement of the Declination) and add them together into one Sum.

2. From half that Sum subtract (to find the Sun's Azimuth) the Sun's Distance from the Pole ; but (to find the Hour) the Complement of his Altitude ; and note the Remainder.

3. *To find the Azimuth, you have these two Proportions following.*

First, As Radius, is to the Sine Complement of the Latitude ; so is the Sine Complement of the Altitude, to a fourth Sine. Then again,

Secondly, As that fourth Sine, is to the Sine of the half Sum ; so is the Sine of the Remainder, to a fifth Sine ; against which, on the Line of Versed Sines, is the Sun's Azimuth from the North in North Latitude ; but from the South in South Latitude.

4. *To find the Hour, these are the two Proportions which follow.*

First, As Radius, is to the Sine Complement of the Altitude ; so is the Sine of the Sun's Distance from the Pole, to a fourth Sine.

Secondly,

Secondly, As that fourth Sine is to the Sine of the half Sum ; so is the Sine of the Remainder to a fifth Sine ; against which, on Versed Sines, is the Hour of the Day from Noon.

Example. In 51 deg. 30 min. North Latitude, the Sun's Declination being 15 deg. 10 min. North, and his Altitude observed to be 11 deg. 30 min. I demand his Azimuth, and Hour of the Day ?

	d. m.		d. m.		d. m.
Latitude	90.00		90.00		90.00
	51.30	North Declinat.	15.10	Nor. Alt.	11.30
Comp. Lat.	38.30	Sun's dif. fro. Pole	74.50	Com. Alt.	78.30
Comp. Alt.	78.30	Comp. Latitude	38.30		
Sun's Dist.	74.50	Comp. Altitude	78.30		
Sum is	191.50	Sum is	191.50		
half Sum is	95.55	The half Sum is	95.55		
Remainder	21.05	Remainder is	17.25		

Then to find the Azimuth, it's thus :

1. As S. 90d. is to S. 38d. 30m. so is Sine 78d. 30m. to Sine 37d. 20m. the fourth Sine.
2. As Sine 37d. 20m. is to S. 95d. 55m. so is Sine 21d. 05m. to S. 36d. against which, on Versed Sines, is 80d the Sun's Azimuth from the North Easterly if in the Forenoon ; but North Westerly in the Afternoon.

And to find the Hour of the Day, it's thus :

1. As Sine 90d. is to Sine 38d. 30m. so is Sine 74d. 50m. to Sine 37d. the fourth Sine.
2. As Sine 37d. is to Sine 95d. 55m. so is Sine 17d. 25m. to Sine 29d. 40m against which, on Versed Sines, is 90d. 30m. or 6 Hours 2 Minutes, which is the Hour from Noon ; that is, 58 Minutes after Five of the Clock in the Morning ; or 2 Minutes after Six in the Afternoon.

The

The Mariner's Compass Rectified.

The Description and Use of the

S E C T O R.

1. **T**HIS useful Instrument may be of any Length, but is commonly made one Foot 8 Inches, or two Feet long, to open with a Joint in the Middle like a Carpenter's Rule; one Inch and an half (or more) in Breadth, and of any Thickness at Pleasure, according to the Matter it's made of; which may be either Box-wood, Ivory, Brass, or Silver.

2. There are two Sorts of *Sectors*, known by the Names of *Gunter's* and *Foster's Sector*; and are sometimes both put on one Instrument; that is, *Gunter's Sector* on one Side of it, and *Foster's* on the other.

3. The Lines on *Gunter's Sector*, are these, *Line of Lines*, (marked at the end with L) *Line of Sines* (marked S) *Superficies*, (marked Sup.) *Solids*, (marked Sol.) *Line of Metals*, *Line of Equated Bodies*, *Line of Inscribed Bodies*, &c.

4. The Lines on *Foster's Sector*, are these Five, viz. *Line of Lines* or *Equal Parts*, *Chords*, *Sines*, *Tangents*, and *Secants*; each marked at the End with its Name, or first Letter of its Name.

5. All *Sector-Lines* or *Scales*, meet at the Center of the Head (where the Joint is) on the Left-hand, and from thence are figured towards the Right, each being twice repeated: that is, one on each Leg or Side of the *Sector*, answering one another.

6. The *Sector* is useful in Projection, to reduce, or to make a Scheme to any possible Magnitude: also in Proportion, to work any stated Canon or Proportion in *Arithmetic*, *Geometry*, *Trigonometry*, *Navigation*, *Astronomy*, &c. of which I will give a brief Touch, yet so as the Learner may be informed how to apply them further.

1. *The*

1. *The Use of the Sector Lines for Projection.*

IN Projection it's often required to enlarge or diminish the Scale, that the Draught designed may be of its desired Magnitude; in doing of which are used Lateral, and Parallel Distances, or Extents of the Compasses; And to avoid a needless saying over the same things, take once for all what's meant by a Lateral, and a Parallel Distance, or Extent of the Compasses.

1. A *Lateral Distance* (in any Line or Scale) is the Extent or Distance (taken along the Length of the Line, or Scale) from the beginning thereof to any Number therein desired.

As for Example, The *Lateral Sine* of 30 degrees is the Distance of 30 from the Beginning of the Line of *Sines*; and so it is in the Line of *Equal Parts*, *Chords*, *Tangents*, *Secants*, &c.

2. A *Parallel Distance* (in any Line, or Scale on the *Sector*) is the Extent or Distance, taken across from any Number in any Line on one Leg of the *Sector*, to the like Number in the like Line on the other Leg of the *Sector*.

Or, the nearest Distance from any Number on one Leg (taken across) to the like Line on the other Leg of the *Sector*.

As for Example: The *Parallel Sine* of 30 degrees is (supposing the *Sector* opened to any Angle) the Distance from 30 in the Line of *Sines* on one Leg of the *Sector*, to 30 in the Line of *Sines* in the other Leg.

Or, the nearest Distance from 30 in the Line of *Sines* on one Leg, to the Line of *Sines* (that is to say, the Line issuing from the Center of the Joint or Head) on the other Leg, is the *Parallel Sine* of 30 degrees. In like manner it is done in any other Line or Scale.

This being understood, the enlarging or diminishing of any of the *Sines*; or the finding a *Chord*, *Sine*, *Tangent*, or *Secant*, to any proposed Radius will not be difficult;

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difficult ; and for the Learner's further Information, take this General Rule.

- I. *To find a Chord, Sine, Tangent, or Secant, &c. to any Radius (greater or lesser) proposed.*

The general Rule is thus ;

1. Take the proposed Radius in the Compasses, and make it a Parallel on the Sector in the Radius of any one Line : that is, open the Sector till the proposed Radius in the Compasses (be a Parallel Chord) of 60 degrees in the Line of Chords ; or a Parallel Sine of 90 degrees in the Line of Sines ; or a Parallel Tangent of 45 degrees in the Line of Tangents ; or a Parallel Secant of 0 degrees in the Line of Secants ; for the Chord of 60, Sine of 90, Tangent of 45, and Secant of 0 degrees are equal, and each equal to Radius.

2. The Sector being kept at that open'd distance or Angle, any Parallel Distance in any Line, will be a Lateral Distance on a like Line to the proposed Radius ; that is ; a Parallel Chord of 10, 20, 30, &c. is the Chord of 10, 20, 30, &c. to the proposed Radius ; also a Parallel Sine, Tangent and Secant of 20, 30, 40, &c. is the Sine, Tangent and Secant of 20, 30, 40, &c. to the foresaid Radius.

II. *The Use of the Sector in working Proportions.*

Supposing the Learner understands how to take a Lateral Distance on the Line of Lines (otherwise called Equal Parts) on the Chords, Sines, &c. And to apply them Parallel in any Line on the Sector ; the working of any Proportion is thus :

A General Rule to work by the Sector.

1. Take the second Term Lateral (that is from the beginning of the Line to the proposed second Term) and opening the Sector, apply that Extent Parallel (that is,

is, across it) in the first Term; then stay the *Sector* at that Parallel Extent.

2. Then take the Parallel Distance of the third Term, and measure it Laterally, gives the fourth Term sought, or required.

Or briefer thus: As the Lateral second Term is to the Parallel first Term; so is the Parallel third Term, to the Lateral fourth Term.

This one Rule is sufficient for any Proportion whatever, and will appear so by a few Examples.

P R O B. I. *To multiply by the Line of Lines on the Sector.*

The Proportion is:

A S 1, is to the Multiplier; so is the Multiplicand, to the Product.

Example. What's the Product of 8 multiplied by 4?

The Analogy, or Proportion, is this;

As 1, is to 4; so is 8 to the Product 32: thus found by the *Sector*, and general Rule aforesaid.

1. On the Line of Lines, (that is the Line of Equal Parts) take the second Term 4 Lateral: that is, from the Center of the Joint, and the beginning of the Line, to 4 in the same Line.

2. Open the *Sector* till you fit the (aforesaid Lateral) Distance in the Compasses in the Parallel of 1 and 1, or 10 and 10: that is, set it over from 10 to 10 at the End of the same Line, and now counted for 1 and 1, the first Term; keep the *Sector* just at that Angle or Opening.

3. The Parallel Distance of the third Term 8; that is from 8 to 8 taken across from one Leg to the other, in the said Line of Lines, and measured Lateral (which is from the beginning of the Line towards the end) and it reacheth to 32, the fourth Term, which is the Product of 8 multiplied by 4. Or shorter thus:

As the Second Term 4 (Lateral taken) is to the first Term 10 (Parallel set;) so is the third Term (taken Parallel) 8, to the fourth Term (measured Laterally,) which is 32, the Product as before. Or thus: As the Lateral 8 is to the Parallel 10, counted for 1; so is the Parallel 4, to Lateral 32, as above.

PROBLEM II.

To divide by the Line of Lines on a Sector.

The Analogy, or Proportion is thus:

As the Divisor, is to 1; so is the Dividend to the Quotient. Or thus:

As the Divisor, is to the Dividend; so is 1 to the Quotient.

Example. How many Square Yards are in 36 Square Feet; *Answer,* 4 Square Yards. For it's thus:

As 9, is to 1; so is 36, to the Quotient 4: thus to be wrought by the *Sector*: As Lateral 1, is to Parallel 9, so is Parallel 36, to Lateral 4, the Yards required.

PROBLEM III.

work the Rule of Three by the Line of Lines on a Sector: or unto Three Numbers given, to find a fourth Geometric Proportion.

The Analogy is:

As the first Term is to the second Term; so is the third Term, to the fourth Term required.

Example 1. If the Diameter of a Circle be 14 Inches; what's the Circumference? *Answer,* 44 Inches. For the Proportion is thus:

As 7, is to 22; so is the Diameter 14, to 44, the Circumference required; by *Sector* thus wrought, As Lateral

teral 22, is to parallel 7 ; so is Parallel 14, to Lateral 44 the Circumference of a Circle whose Diameter is 14.

Example 2. If a Plank or Board be 15 Inches broad, and 20 Feet long ; how many Feet is in it ? *Answer, 25 Feet ;* For the Proportion is this :

As 12 is to 15 the Breadth, so is 20 the Length, to 25 Feet, the Content of the Board. And by the *Sector* thus to be wrought. As Lateral 15, to Parallel 12, ; so is Parallel 20, to Lateral 25 Feet, the Content of the Plank.

PROB. IV. *The Use of the Sector in Plain Sailing.*

Example 1. A Ship in 42d. 10m. North Latitude, sails N.E. by N. 104 Leagues ; I demand the Latitude she is in, and her Departure from the Meridian ?

The Proportions are these :

1. As Radius, to the Distance sailed, so is the Sine of the Course, to the Departure from the Meridian. That is, by the *Sector* thus : As Lateral 104 Leagues (on the Line of Lines) is to Parallel Sine of 90 degrees, so is Parallel Sine of 33 degrees 45 minutes (the Degrees of the Course from the Meridian to Lateral 58 Leagues on (the Line of Lines) the Departure from the Meridian.

Note, If 104 Leagues taken Lateral be troublesome, to fit Parallel in Sine of 90 Degrees : then take it's half, or quarter Lateral ; and the Answer will be accordingly its half or quarter : As here, if you take 52, the half of 104 Leagues ; the Answer would be 29, whose double is 58 for the Departure from the Meridian, as before.

As Radius is to the Distance sail'd ; so is the Sine Complement of the Course, to the Difference of Latitude.

By the Sector thus :

As Lateral 104 Leagues, is to Parallel Sine of 90 deg. so is Parallel Sine of 56 deg. 15 minutes, to Lateral 87 Leagues, the Difference of Latitude ; by which you may find the Latitude the Ship is in, as before in the Use of the *Gunter* in Page 208 and 209.

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Example

Example 2. *A Ship sails South Easterly, 'till her Difference of Latitude be 275 Minutes, and the Departure from the Meridian be 412 Minutes; I demand her Course and Distance sailed?*

The Proportions are these :

1. As the Difference of Latitude, is to the Departure ; so is Radius, to the Tangent of the Course. That is,

By the Sector thus ;

As Lateral 412 Minutes, is to Parallel 275 Minutes ; so is Parallel Tangent of 45d. (that being Radius now) to Lateral Tangent of 56d. 15m. the Course from the Meridian, which makes S. E. by E.

2. As the Sine of the Course, is to the Departure ; so is Radius, to the Distance sailed.

By the Sector thus ;

As Lateral 412 min. is to Parallel Sine 56 deg. 15 min. so is Parallel Sine of 90 deg. (that now being Radius) to Lateral 495 min. the Distance sailed.

After this manner may any Proportion be wrought by the *Sector*, which I leave for the Learner's Exercise.

The Use of the following TABLES of Latitude and Longitude.

L *Atitude* and *Longitude* are two primary Affections of the Earth : By the Help of these two doth the *Geographer* strive to represent the Parts of the Earth, that they may keep symetry and harmony with the whole.

Latitude is an Arch of the Meridian, comprehended between the Equinoctial and a Parallel. But *Longitude* is an Arch of the Equinoctial, intercepted between the Meridian of *London*, and the Meridian of any other Place.

For the exact settling of *Latitude*, we have many absolute Helps ; but the *Longitude* of a Meridian, is that

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which hath, and still wearieth the greatest Masters of *Geography*.

I have endeavoured to settle the Longitude with as much Exactness as possible I could: For I not only calculated according to the Latitude and Meridian Distance of each Place from the Meridian of *London*; which Meridian Distance I obtained from the exactest *Geographic Charts* extant, but I consulted with the Reckonings of skilful Mariners, and when I found any Difference, I composed it both according to Art and Reason.

As for Instance; I had from able Mariners, upon their long Experience, the Meridian Distance from *Barbadoes* to the *Lizard*: According to which I have settled the Longitude of all the eminent Places in the *West-Indies*.

And for the settling of the Longitude of Places in *East-India*, I consulted Observations of Eclipses, both Ancient and Modern; as in Page 161 of *Harmonicon Cœleste*, the Difference of Meridians between *Goa* and *London*, is 5h. 48m. and *Malacca* and *London* 6h. 49m. My Table hath the former of these 5h. 58m. and the latter 6h. 45m. the difference between my Table and the former of these Observations is 10m. and of the latter 4 min. which difference may be born withal.

“ If the Reader considers the time, being 1664. with the great *Labour* and *Pains*, (to my Knowledge, being then his Servant,) the *Author* bestowed, and expended in performing this *Work*, they were then the best of this Kind.

“ But since that *Time* there hath been better Helps, new Discoveries made, and new Places found out; the *Corrector* at the Request of the Bookseller, and out of Respect to the deceased *Author*, but most of all for the Publick Good, hath made such Amendments herein as was possible, by comparing of the best *Observations, Tables, Charts, Maps, and Sea-Journals*, he was able to procure; so that it may be concluded, These *Tables* are

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“ the *Truest*, or come (in the general) nearest the *Truth*
“ of any extant in our Language; not that they are so
“ exact in every particular Place, as to need no A-
“ mendment in time, but with respect to the present
“ Help they are so.

“ And now I could wish that either *Authority* would
“ order, or that all concerned in setting forth *Latitude*
“ and *Longitude*, *Tables*, *Charts*, and *Maps*, would
“ mutually unite in a fixed Meridian where to begin
“ *Longitude*

“ For altho’ *Longitude* may be begun at any Meri-
“ dian, yet the Convenience of its beginning at one
“ Meridian, in all our *English Navigation Books* and
“ *Charts*, would render the Study and Practice of *Na-*
“ *avigation* much more pleasant and easy than now it
“ is: Such various beginnings and countings of *Longi-*
“ *tude*, occasion some to stumble, others to mistake,
“ and some to condemn all to be false, by not consider-
“ ing the several Meridians made use of, which such a
“ wished Union would prevent.

“ But this is not likely in my Time, who am so near
“ the *Grave*; yet should it be set on Foot, while I am
“ on this side the other World, my best Performances
“ should not be wanting to promote it, and should count
“ all my spare Hours from necessary Preparations for
“ my *Last End*, well spent in such a *Useful* and *Publick*
“ *Good*”.

Helps, Note 1. I do begin the *Longitude* (in my *Tables*) at the
Meridian of *London*, and encreasing it on both sides the
Meridian; that is to say, both Eastward and West-
ward, and end in 180 deg. the opposite Meridian.

2. Therefore (according to this Account) all Places
on the East side of the Meridian of *London* lie in East Lon-
gitude; and on the contrary, all on the West side of it lie
West Longitude.

3. If a Ship be in East Longitude, sailing to the East-
ward

ward, the Longitude increaseth; but failing to the Westward, the Longitude decreaseth.

4. And on the contrary, if a Ship be in West Longitude, failing to the westward, the Longitude increaseth, and failing to the Eastward, it decreaseth.

5. Take Notice, that at all Places in East Longitude, the Sun cometh on their Meridian before he cometh on the Meridian of *London*. As thus; if a Place lie in 15 deg. East Longitude, the Sun cometh one Hour sooner to the Meridian there, than he doth to the Meridian of *London*: If in 30 deg. East Longitude, then two Hours sooner; if 45 deg. three Hours sooner; if 60 deg. four Hours sooner; if 75 deg. five Hours sooner; if 90 deg. six Hours sooner; if 105 deg. seven Hours sooner; and so you may reckon for any other Longitude. But on the contrary, All those Places that lie in West Longitude, the Sun or Star cometh on their Meridian after he is past the Meridian of *London*.

To find the Difference of Longitude between any two Places.

IF both Places be in East Longitude, or both in West Longitude, subtract the lesser Longitude out of the greater, the Remainder is the Difference of Longitude.

If one Place be in East Longitude, and the other in West Longitude, add both together, and their Sum is the Difference of Longitude,

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A TABLE containing the Chief Harbours, Headlands and Islands in the World, shewing their Latitude and Longitude: Beginning the said Longitude at the Meridian of London.

The Coast of Greenland.

Names of Places.	Latitude		Longit.	
	D	M	D	M
H Acluits Headland	79	55	11	50
Fair Foreland	79	18	10	50
Cape Cold the North End of }	79	00	10	00
Charles Isle	79	00	10	00
Black Point, South End of it	78	00	10	30
Dear Sound	79	15	12	40
Foul Sound	77	30	12	50
Bell Sound	77	15	12	40
Horn Sound	76	40	13	36
Point Lookout	76	25	15	36
Helies Sound	79	11	21	50
Cape Barcan	78	22	22	11
Cape Blanco	77	50	22	30
Ducks Cove	77	45	23	10
Negro Point } Edges Island	76	55	23	30
Hope Island	76	20	23	45
Cherry Island, or Bear Island	74	50	18	08
Ice Point, or Cape Desire	77	40	69	10
Admiralties Island	75	05	59	50
Langeness	74	40	53	36
Cross Point	72	00	53	12
Perum Burrough	70	00	61	20
Colgoyen Isle	69	20	45	00
Cape Candemose	69	25	42	35
Cape Barso	66	30	58	00

North Latitude

East Longitude

Sea Coasts from *Archangel* to the *Naze* of *Norway*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Archangel	64	30	40	30
Cape Grace, or Cape Bona Fortuna	66	00	36	30
Cape Gallant, or Sweetnose	68	10	34	45
Kilduyn Island	69	30	31	20
River Kola Entrance	69	00	31	05
Fishers Island	70	00	26	38
North Cape	71	25	23	02
Tromsøund Island	70	30	15	30
Island Sanien, South Point	69	30	13	00
Loeford, West Point	67	52	9	00
Werro or Weroy Island	67	10	7	30
Dronten	63	45	10	15
Ranfel	63	25	6	30
North Point	62	20	5	26
Katts Ness, or Scutts Ness South Point	61	45	3	36
Hearle Island the South-end	60	40	3	38
North Bergen	60	15	5	40
Bommel Island, North Point	59	30	5	40
Jedder	58	10	6	10
Naze of Norway	58	00	7	22
Maesterland	57	50	11	40

North Latitude

East Longitude

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Sea Coasts in the Sound.

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East Longitude

Names of Places.

Latitude
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Maerden	58	25	08	55
Caperwick	59	20	10	10
Nilloo on Christiana	59	45	10	00
Gottenberg Gat	58	07	12	15
Cape Kol	56	30	12	12
Ellenburgh	56	20	12	30
Valsterborn	55	35	13	00
Christianople	56	20	16	00
Calmer	56	45	16	35
Oeland the	56	15	15	30
South End				
North End	57	25	17	00
Landfort	58	40	18	20
Stockholm	59	20	18	15
Abo	60	40	21	10
Raseborgh	60	28	22	30
Borgo	60	40	26	00
Pelting Sound	60	32	26	50
Wyburgh	60	40	29	16
Petersborough	60	30	30	20
Narva	59	47	28	25
Revel	59	35	24	51
Nargin Island	59	35	24	30
Sybranets in Dagoo, or Dagarol	59	00	23	00
Arensberg in Oesel Island	58	00	23	30
Parnaw	58	25	25	47
Runen Island	57	55	24	00
Ryga	57	04	25	15
Domeness	57	30	24	00

North Latitude

West Longitude

Sea Coasts in the Sound.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Der Winda	57	15	22	06
Der Memel	55	30	21	36
Coningsberg	54	43	21	35
Dantzick	54	04	19	02
Heel	54	40	19	08
Gotland, the North End	58	03	18	50
Faro Sound				
Gotland Wisbuy	57	25	18	30
Gotland, the South End	57	00	17	45
Bornholm	55	15	14	45
Camin or Hamin	54	15	15	00
Jasmond, or Rugen	54	45	14	00
Rostock	54	37	11	40
Straelfound	54	37	13	16
Wismar	54	30	12	00
Lubeck	54	46	09	55
Copenhagen	56	13	12	50
Ellenore	56	33	12	32
Uraniberg	55	54	12	50
Anout Island	57	10	11	06
Lefon or Lefnow Island, or Jesou	57	05	10	30
The Scaw	57	26	10	10

The Sea Coasts of *Holland* and *Flanders* from the *Scaw* to *Calais*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Holy Land, or Helighland Isle	54	24	08	35
Hambrough	53	41	10	35
Bremen	53	50	09	00
Emden	53	05	07	35
Ameland Isle	53	30	06	20
Scheling	53	25	05	58
The Fly	53	15	05	30

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Rage Poi
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Bargarers
Silly, or
Horn Bay
Merchant
Portland
Greens Isl

*The Sea Coasts of Holland and Flanders, from the Scaw
to Calais.*

Names of Places.	Latitude		Longit.	
	D	M	D	M
The Texel	53	15	5	10
Amsterdam	52	23	5	10
Rotterdam	51	55	4	20
Antwerp	51	10	4	20
The Brill	52	08	4	00
Middleburgh in Zealand	51	35	3	50
Sluys	51	14	3	43
Ostend	51	07	3	25
Dunkirk	51	01	2	27

North Latitude

East Longitude

The Sea Coasts about the Island of Iceland.

Grimes Hole, or Geuberman's Rocks	66	23	29	30
Gamat Isles, or Gille	65	48	26	54
Westmania Isles	63	45	22	54
Rook Point	64	00	26	23
Snow Hill	65	11	27	14
Fair Foreland	66	20	26	27
Rage Point, or Orgel Bay	66	00	25	24
Marza, or Largeness	66	08	24	00
Grimsa Isle	67	15	22	34
Lange Ness	66	56	12	50
Bargarers Point	66	20	16	35
Silly, or Papey Isle	64	50	12	10
Horn Bay	64	50	12	00
Merchants Foreland	63	25	17	05
Portland	64	02	21	05
Greens Island	66	50	24	40

North Latitude

West Longitude

The Sea Coasts of Scotland.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Sky Island, North End	57	45	5	25
Island Lewis, North End	58	20	7	00
Farro Head	58	23	5	10
Shetland South End	60	02	2	00
Fair Isle	59	30	2	20
Isles of Orkney	59	10	3	22
Cath Ness	58	37	2	16
Buchan Ness	57	45	1	08
Aberdeen	57	22	1	37
Dundee	56	28	2	40
Leith	56	00	2	55
Edenburg	55	57	2	55
Berwick	55	50	1	40

North Latitude
West Longitude

The Sea Coasts of England from Berwick to the Lizard.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Newcastle	54	58	1	30
Shelles	55	02	1	20
Sunderland	54	52	1	20
Hartlepool	54	40	0	54
Whitby	54	30	0	50
Scarborough	54	20	0	40
Flamborough Head	54	08	0	11
Barlington	54	00	0	06
The Spurn	53	45	0	13
Hull	53	50	0	28
Grimesby	53	30	0	56
Boston	53	09	0	25
Lynn	52	55	0	32
Wells	53	07	1	00
Blackney	53	20	0	55
Cromer	53	10	1	05

North Latitude
East Longitude
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Torbay
Darmou
The Star

The Sea-Coasts of England, from Berwick to the Lizard.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Winterton	53	02	1	22
Yarmouth	52	45	1	58
Alborough	52	20	1	25
Orfordness	52	17	1	11
Ipswich	52	14	1	00
Harwich	52	11	1	18
Colchester	52	00	0	58
LONDON	51	32	0	00
Rocheſter	51	28	0	25
Marget	51	29	1	10
The North Foreland	51	28	1	19
Sandwich	51	27	1	9
The Downs	51	25	1	21
The South Foreland	51	12	1	18
Ripraps	51	53	1	25
Dover	51	15	1	18
Dongeneſs	51	00	0	51
Rye	51	03	0	45
Beachy	50	48	0	25
Shoram	50	55	0	17
Portſmouth	50	48	1	00
Iſle of Wight	50	45	1	10
Pool	51	00	1	50
Weymouth	50	43	2	40
Portland	50	30	2	48
Chiddock	50	47	3	00
Lime	50	45	3	14
Topſham	50	37	3	27
The Berry	50	25	3	49
Torbay	50	32	3	38
Darimouth	50	27	3	36
The Start Point	50	7	3	45

East Longitude

North Latitude

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West Longitude

West Longitude

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East Longitude

The Sea Coasts of *England*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
The Eddystone	50	12	4	20
Plymouth	50	36	4	13
Ramhead	50	14	4	35
Foy	50	25	4	30
Falmouth	50	12	5	12
LIZARD	50	00	5	24

The Sea Coasts from the *Lizard* to *Holy Head*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Lands End	50	06	6	00
Gulf	50	00	6	06
Scilly Islands, the middle	50	00	6	45
Seven Stones	50	10	6	40
Hartland Point	51	06	4	35
Londey Isle	51	20	4	40
Mort Bay	51	12	4	40
Bristol	51	32	2	35
Swandsey	51	40	4	25
Caldy Island	51	33	5	14
Milford	51	45	5	15
St David's Head	57	00	5	22
Barfey Isle	52	44	5	00
Liverpoole	53	20	3	00
Westchelter	53	37	4	20
Lancaster	54	40	4	35
White Haven	54	17	3	50
Isle of Man, West End	53	45	5	00
Holy Head	53	24	4	50

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Isles o
Gallow
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Limri
Blasqu
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Cow a
Mizan
Old H
Cape
Kinsal
Cork
Water
Wexfo
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Calais
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The Coasts of Ireland.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Fair Foreland	55	05	06	30
London Derry	55	00	08	00
Island Torre	55	08	08	30
Isles of Arran	54	48	08	59
Stays of Broad Haven	54	07	10	05
Isles of Arian	54	55	09	50
Galloway	53	07	09	40
Gall, or Doen's Head	52	40	09	30
Lupis's Head	52	24	10	15
Limrick	52	23	09	35
Blasques	52	00	11	55
Skillocks	51	30	11	55
Cow and Calf	51	22	10	36
Mizan Head	51	15	11	30
Old Head of Kinsale	51	35	08	58
Cape Clear	51	10	10	30
Kinsale	51	50	09	40
Cork	51	49	09	30
Waterford	52	09	08	40
Wexford	52	13	07	27
Dublin	53	12	06	55
Lambay	53	24	07	30

North Latitude

West Longitude

The Sea Coasts of France.

Calais	50	57	01	50
Diep	49	56	01	55
St. Valery	50	10	00	56
Sain Head, or Cape de Antifer	49	44	00	24
Roven Mouth	49	36	00	30
Cape Berfleur	49	47	01	12W
Cape de la Hague	49	48	02	03W

North Latitude

East Longitude

The Coast of *France.*

Names of Places.	Latitude		Longit.	
	D	M	D	M
Alderney	49	50	2	12
Caskets	49	50	2	17
Guernsey	49	36	2	38
Jersey	49	20	2	18
St Maloes	48	38	2	5
Morlaix	48	36	3	49
Island de Bas	48	50	4	0
Ushant	48	30	5	6
Conquet	48	25	5	5
Brest	48	23	4	25
Camarita Bay	48	25	4	28
Seams	48	4	5	1
West Penmarks	47	47	4	24
Bell Isle	47	17	3	15
Nantz	47	15	1	49
Heys Isle	46	24	2	14
Isle de Rey the middle	46	10	1	30
Oleron	46	00	1	0
Rochel	46	10	0	58
Bourdeaux City	44	50	0	25
St. Sebastian	43	32	1	27
Bilboa	43	32	2	58
Cape Pinas	44	44	6	0
Cape Ortegal	44	02	7	42
Cape Coruna or Groin	43	28	9	20
Cape Finistere	43	10	10	0
Isles of Bajona	42	22	9	24
Oporto	41	18	9	25
Burlings	39	40	10	30
Rock of Lisbon	39	00	9	50
Lisbon	38	43	9	2
Cape St. Vincent	37	06	9	30
Cape St. Maria	36	58	8	30
Cadiz	36	18	6	29

North Latitude

West Longitude

The S

Gibralte
Malaga
Cape de
Cape Pa
Allicant
Cape Ma
Barcelon
Marseil
Toulon
Genoa
Leghorn
Civita V
Rome
Naples
Cape Sp
Cape Co
Gallippo
Cape St.
Ancona
Venetia
Zara
Ragusa
Cattaro
La Valc
Point F
Lepanto
Cape M
Cape St
Athens

The Sea Coasts on the Main Continent within the Straits.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Gibraltar	36	10	05	20W
Malaga	36	50	03	17W
Cape de Gat	36	57	01	30W
Cape Paul	37	50	00	15W
Mlicant	38	35	01	20
Cape Martin	38	50	01	45
Barcelona	41	26	02	35
Marseilles	43	20	05	27
Toulon	43	07	05	50
Genoa	44	27	09	50
Leghorn	43	18	10	30
Civita Vecchia	42	04	11	50
Rome	41	54	12	57
Naples	40	57	14	27
Cape Spartavento	38	00	17	30
Cape Colonne	39	10	18	05
Gallipoli	40	08	19	00
Cape St. Maria	39	55	19	30
Ancona	43	40	14	53
Venetia	45	40	12	50
Zara	44	15	16	55
Ragusa	42	45	20	00
Cattaro	42	40	20	30
La Valona	40	55	21	15
Point Palermo	40	05	21	40
Lepanto	38	25	22	50
Cape Matapan, or Caglia	36	40	23	25
Cape St. Angelo, or Angulo	36	45	24	10
Athens	38	00	24	45

North Latitude

East Longitude

West Longitude

The Sea-Coasts on the Main Continent within the Straits.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Cape Martelo South Point of Negropont }	38	00	26	00
Cape Colom, or Colomni	37	30	25	25
Salonica	40	41	23	13
Cape Monte saneto	40	05	26	10
Galippoli	40	30	28	00
Constantinople	41	07	29	00
Cape Barbador	39	00	27	50
Smyrna	38	28	27	24
Cape Barbernola	38	35	27	55
Ephesus	37	45	27	20
Antiochetta	36	35	32	15
Scanderoon	36	35	37	05
Tortosa	35	18	37	00
Antiocha	35	54	37	20
Tripoli	34	35	36	54
Joppa, or Jaffa	32	30	35	15
Cayro	30	04	31	31
Alexandria	31	11	30	45
Cape Rufato	33	20	22	30
Cape Mesurato	32	45	17	10
Tripoli	32	54	13	05
Susa	35	50	19	02
Cape Bona	37	06	10	30
Tunis	36	55	10	00
Bona	37	03	09	00
Gigeria	37	06	06	30
Cape Tidelles	37	04	05	00
Algier	36	40	03	05
Cape Tenes	36	30	01	45
Oran	36	00	00	45
Cape Tres Forcas	35	35	01	30
Ceuta	35	45	04	55
Tangier	35	40	05	10

East Longitude

North Latitude

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Middle
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Messina
Siracus
Pantala
Limoss
Lampio
Semette
Cape P
Malta
Grande
Scio, o

Islands within the *Straits*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Formentura	38	43	1	40
Ivica	39	5	2	0
Majorca	39	35	3	0
Minorca	39	45	4	0
South	38	56	9	2
North } End of Sardinia	41	0	10	0
Afinara	41	0	9	30
South } End of Corsica	41	20	9	16
North }	42	55	10	0
Capraia	43	6	10	27
Lilbo, or Elba	42	45	11	0
Planosa	42	32	10	39
M. Christo	42	15	11	7
Palmarolla	40	50	13	0
Ponsa	40	40	13	7
Ischia, or Eschia	40	46	14	30
Strombello	39	00	16	30
Volcanello	38	48	16	0
Fellicur	38	50	15	7
Allicur	38	45	14	40
Ustica	38	54	14	4
West End	37	52	13	13
Middle End } of Sicilly	37	42	15	6
East End }	37	7	17	0
Messina } in Sicilly	38	21	16	40
Siracusa }	37	7	15	55
Pantalasia	36	53	13	9
Limossa	36	20	13	41
Lampidosa	35	50	13	30
Semetto	35	56	13	25
Cape Passaro in Sicilly	36	52	16	0
Malta	35	54	14	40
Grande	44	0	16	25
Scio, or Xio	38	20	25	55

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East Longitude

North Latitude

East Longitude

Islands within the Straits.

Names of Places.	Latitude		Longitude	
	D	M	D	M
Poma	43	14	16	0
St. Andrea	43	7	16	7
Lissa	43	0	16	14
Agusta	42	56	16	39
Corzola	42	53	16	44
Melada	42	47	17	19
Corfu	39	45	21	20
Cephalonia	38	15	21	49
Zante	37	47	22	4
Sapienza	36	50	22	42

North Latitude

East Longitude

Islands in the Archipelago

Taffo	40	10	26	45
Lemnos	39	46	27	15
Metelin	38	54	29	18
Metelino	38	50	28	17
Siatto	39	10	25	45
Tino	37	25	26	49
Sia, Sea, or Sira	37	25	25	57
Femina, or Fermina	37	18	25	54
Serfanto, or Sifanto	36	58	26	15
Millo, or Mile, or Mela	36	40	25	55
West } end of Candia { Cape St. John	35	18	24	10
East } Cape Solomon	35	24	26	00
Rhodes	36	42	28	05
West } end of Cyprus { Cape St. Pifano	35	15	32	53
East } Cape St. Andrea	35	30	36	00

North Latitude

East Longitude

The Sea Coasts of *Barbary* and *Guiney*, from *Tangier* to *Cape Ecna Esperance*.

Cape Sparte	35	56	5	50
Salle	33	45	6	30
Cape Cantin	32	16	9	10
Cape de Geer	30	20	10	10

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*The Coasts of Barbary and Guiney, from Tangier to
Cape Bona Esperance.*

Names of Places.	Latitude		Longit.	
	D	M	D	M
Cape de Non	28	25	11	30
Cape Bajadore	26	12	15	55
Cape Blanco	20	22	17	45
Cape de Verd	14	43	17	10
River of Gambia	13	17	16	01
Cape Roxo	12	00	16	00
Cape de Monte, or Mount	6	03	12	00
River Sessler	5	00	9	06
Cape de Palmas	4	33	7	25
River St. Andrea	5	00	4	15
Cape Three Points	4	13	2	15
Cape Corse	4	40	2	24
River de Valto, or Accara	5	50	3	25
Cape Formosa	4	08	7	40
New Calabar Entrance	4	22	9	33
Old Calabar Entrance	3	30	10	45
River de Camarones	3	20	11	30
Island Fernando	2	40	11	00
Island de Principie	1	40	9	15
River de Anger	0	40	1	35
Island St. Thome	0	00	8	20
Island St. Matthews	1	40	5	11W
Island Ascension	8	00	14	45W
Island Anabona	1	10	7	17E
Cape Lepas	1	05	10	55E
Cape Negro	16	08	12	31E
Island St. Helena Nova	16	00	6	04E
Island St. Helena	15	56	4	10W
River Congo	05	40	15	25E
Cape St. Thomas	23	10	14	23E

The Sea Coast of *Barbary* and *Guiney*, from *Tangier* to
Cape *Bona Esperance*.

Names of Places	Latitude		Longit.	
	D	M	D	M
Cape <i>Setos</i> , <i>Sego</i> , or <i>Seca</i> ———	29	00	14	55E
Cape <i>Bona Esperance</i> ———	34	15	16	35E
Cape <i>Anguillas</i> , or <i>Lagullas</i> ———	35	00	18	20E
Island <i>Tristian</i> ———	36	57	16	10W

The Sea Coasts of *Brazille*.

Names of Places	Latitude		Longit.	
	D	M	D	M
Island <i>St. Paul</i> ———	1	20 N	24	30
<i>Para</i> ———	2	50	37	55
Cape <i>St. Roque</i> ———	5	0	35	47
<i>Rio Grande</i> ———	5	30	36	15
<i>Pernambuco</i> ———	7	48	36	5
Cape <i>St. Augustin</i> ———	8	5	35	40
Island <i>Ferdinando Loxombo</i> ———	3	50	33	0
River <i>St. Francisco</i> ———	10	45	37	50
Bay de <i>Todos Sanctos</i> ———	13	0	41	0
Port <i>Segura</i> ———	16	11	41	15
River <i>St. Antonio</i> , or <i>River Grande</i> ———	15	40	42	10
Cape de <i>Albrolhor</i> ———	17	50	42	15
<i>Spirito Sancto</i> ———	19	55	42	10
Cape <i>St. Thomas</i> ———	22	10	42	0
Cape <i>Frio</i> ———	23	0	42	45
Island <i>St. Katherina</i> ———	28	0	50	0
River <i>Grande</i> ———	31	55	54	0
Cape <i>St. Matia</i> ———	34	30	57	20
River de la <i>Plata</i> , or <i>Cape St. Antonio</i> ———	35	20	57	30
Cape de <i>St. Andreas</i> ———	38	50	63	15
Bay <i>Sifunda</i> , or <i>Sifendo</i> ———	42	45	69	0
Point de los <i>Leones</i> ———	44	10	71	20
River <i>Camerones</i> ———	46	30	73	0
Cape <i>Blanco</i> ———	46	50	72	5
Point of River <i>St. Julian</i> ———	48	40	74	32
Cape <i>Virgin Mary</i> of <i>Magel. Straits</i> {	52	00	75	5
Le <i>Maire Straits</i> }				

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The Sea Coasts of Brazille.

Names of Places.	Latitude		Longit.	
	D	M	D	M
C. Horn, the S. part of Terra del Fuego	57	30	79	55
Island dos Picos	22	30	25	15
Island de Martinvas	19	30	26	55
Island St. Maria de Agosta	18	40	28	10
Island Trinidada	20	27	29	44
Island Ascension	19	20	33	25

The Coasts on the Main Continent in the East-Indies.

Bay de Allogoor Dallagoa	25	30	31	05
River St. Lucia	28	30	30	15
Cape St. Martin, or Maria	22	40	35	5
Cape Corantes	23	10	35	25
Mosambique	15	4	40	30
P. de Aguada, or Del Gada	10	17	40	15
Cape de Falso	9	00	38	50
Tongon	4	50	38	57
Mombaso	3	50	38	30
Molinde, or Melinde	2	50	39	30
River de Lamos	1	20	40	13
Magadoxa	2	00	44	20
Cape de Bassas	4	00	48	20
Cape Guardefoy	17	40	52	00
Aden	13	00	48	00
Mocha	14	40	45	20
Cape de Matriaca	15	23	52	10
Defar	17	00	54	35
Cape Rosulgat	22	37	60	45
Muscat	23	32	59	45
Bafora, or Bufero	30	00	50	00
Gambaroon	27	20	56	40
Cape Glado	25	59	63	34

The Sea-Coasts on the Main Continent in the *East-Indies*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
River de Sinda, or Cinde	24	45	67	35
Diu Head	20	42	69	30
Surrat	20	56	73	05
Demau	20	06	73	30
Bombay Island	18	58	73	10
St. John's	19	55	73	20
Chaul, or Choale	18	31	73	37
Dabul	18	03	74	00
Rojapore Isle	16	45	74	25
Goa	15	18	74	37
Carwer	14	47	75	00
Manulore	12	43	75	55
Tellecherry	11	42	75	25
Callecut	11	17	75	20
Cannanou	10	22	75	35
Cochin	09	58	75	45
Anjanga	08	29	76	25
Cape Commorine	07	55	76	55
Colombo in Zeyloan	07	07	79	30
Point de Galle on the same	06	06	80	00
Dundre Head on the same	06	02	80	45
Great Bassas Shoals	06	23	81	45
Jetrapatam	09	50	80	10
Negrapatam	11	01	79	55
Trincumbar	11	15	79	50
Porta Nova	11	45	79	44
For St. David, or Tegapatam	12	05	79	48
Conymere	12	33	80	05
Fort St. George, or Madraffapatam	13	08	80	15
Pullacat	13	30	80	22
Armegon	14	16	80	12
Petopoly	16	06	80	42
Due point, or Meeha	16	08	81	20
Mafulapatam	16	22	81	10

North Latitude

East Longitude

The Sea Coasts on the Main Continent in the *East Indies*

Names of Places	Latitude		Longir.	
	D	M	D	M
Maffipore	16	30	81	57
Vifagapatam	17	43	83	57
Bimlapitam	17	51	84	09
Pondy	18	49	85	15
Jacarnaut Pagod	19	51	86	42
Arsepure	20	11	87	13
Point Palmiras	20	45	87	52
Balafore	21	16	87	48
Piply	21	25	87	57
Hughly	23	07	89	04
Dacca	23	57	90	55
Cafimbazar	25	06	88	45
River Bengal	22	27	91	54
River Aracan	20	10	93	40
Pegu	18	05	95	40
Mallacca	03	20	100	55
Formosa	02	05	101	30
Point Romania	01	16	103	15
Point Cui	12	10	99	02
Siam Entrance	14	18	100	50
Cambodia Entrance	10	20	105	15
Cape Anarilla, or Avarilla	13	25	108	03
Cochin, or Chinchin	14	05	107	50
Tonquin	20	50	105	40
Canton	23	20	113	05
Amoye Island	24	35	116	50
Hockfew	26	50	118	20
Riper Swadia	27	51	118	50
Limpo, Lingpo, or Ningpo	29	58	120	25
Island Chufan	30	00	120	35
Nanquin	34	55	117	05
Pekin	39	55	117	00

Islands in the *East Indies*.

Romanas de Castelameffs	28	45	57	17
St. Joan de Lisbon	25	24	53	30
Diego Roys	19	50	61	30
St. Brandon	16	30	64	10

Islands in the *East-Indies*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Mauritias	20	5	54	55
Malha	11	15	60	30
South } Eud of St. Laurence {	26	7	46	20
North }	12	3	51	45
St. John de Noya	17	31	42	30
St. Christova	17	36	43	40
Mayotta	13	10	45	38
Joanna	12	15	44	33
Mohilla	12	15	43	53
Camaro or Angazecha	11	40	43	50
Morfia, or Monfia	8	07	40	14
Zouzibara	6	40	39	45
Penda	5	20	39	35
Comoro	9	30	44	30
Cosmelodo	10	00	50	45
John de Nova	9	30	52	40
Astore Isle	9	35	54	10
Agalega	9	37	55	11
Sette Harmanes	2	47	59	14
Island Quevelo, or Quebello	3	53	52	36
Bassas de Banhas	5	10	49	16
Hermanos	3	32	54	45
Island Gratio	6	10	63	01
Padra Banhas	7	10	65	31
Bassas de Chages, or Island de Chagos	7	15	69	05
Three Germans	4	30	62	43
Cross Island	4	10	58	05
Sacatra	12	28 N	55	17
Island Abdelcure	12	12 N	54	04
Cubello	8	30 N	71	35
Malique	9	00 N	72	58
Garipe, or Gripe	10	40 N	72	38

South Latitude

East Longitude

Qualp
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Islands in the East-Indies.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Qualpena	10	0	73	30
Andomaon, or Anatada	11	10	73	32
Ceyloan, South End	5	50	80	15
Maldive } South { Part	0	30	76	35
} North {	7	7	73	5
Yas de Digo Rays	0	20	72	0
Manilla	13	55	117	6
Aynain } N.W. { Point	19	30	107	10
} N.E. {	19	55	109	55
Japan } S.E. { Point	35	30	135	30
} S.W. {	35	10	127	30
Island Cocos	14	10	91	2
Island Andaman	13	00	91	19
Borneo	4	20	109	55
Nicobar Island	7	01	92	40
North End of Sumatra	5	30	93	50
Bencola	3	50 S	101	18
South End of Sumatra	5	42 S	104	19
Jambe	1	19 S	102	55
Bantam	6	7 S	105	25
Batavia	6	15 S	106	9

North Latitude

East Longitude

The Southern Islands, or Cape de Verd Islands.

St. Antonio	17	12	25	40
St. Vincent	16	48	25	29
St. Lucia, or Round Island	16	45	25	16
St. Nicholas	16	35	24	22
Isle de Sall	16	45	22	35
Bonavista	16	5	22	27
Mayo, or Island May	15	10	22	25
St. Jago	15	8	23	16
Fuoge	14	45	23	55
Brava	14	27	24	30
St. Paul	01	20	24	30

North Latitude

West Longitude

The Canary Islands.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Sancto Porto	32	50	15	55
Madera West End	32	20	17	30
Salvages	30	00	16	50
Palma	28	30	17	56
Perro	28	00	18	05
Gomera	28	05	17	55
Pico Tenariff	28	25	17	15
Grand Canaria	27	40	16	10
Allegranfa	28	55	12	53
Lancerotta	28	32	13	10
Forteventura	27	55	13	50

The Western Islands.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Corvo	40	02	31	29
Flores	39	40	31	24
Fyal	39	09	29	25
Pico	38	45	28	22
St. George	39	02	28	08
Tercera	38	55	26	44
Gratiosa	39	25	27	54
Whale Fish	39	22	24	11
Vajo, or Vegia	38	43	23	47
St. Michael	37	56	24	26
Formigas, or Hermigas	37	25	23	37
St. Maria	36	58	24	18

The Sea-Coasts of the North Part of America, Hudson's Bay and Newfoundland.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Cape Farewell	59	45	46	45
Cape Elizabeth	92	02	66	50
Island Resolution	61	55	65	40
Queen Ann's Foreland	63	30	74	55
Salvages Island	62	40	70	17
Salisbury Island	63	48	77	30
Mill Isles	64	20	80	08
Nottingham Isle	62	40	79	53

The Sea Coasts of the North Part of America, Hudson's Bay and Newfoundland.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Shark Point	64	30	82	55
Cape Southampton	62	01	87	48
Sir Thomas Roe's Welcome	64	15	92	04
Cape Churchill	59	00	93	00
Port Nelson, or York Fort	57	10	92	55
New Severn	56	00	88	10
Cape Heneretta Maria	55	07	84	10
Viner's Isle	53	05	83	13
Albany Fort	52	26	84	14
Moose River's Mouth	51	00	83	34
Point Comfort	51	17	81	22
Frenchman's River	51	10	80	15
Rupert's River	51	16	79	28
Charlton's Island	52	08	81	28
Danby Island	52	05	80	10
Shephard's Island	51	30	79	48
Solomon's Temple Island	53	05	79	56
Western's Isle	52	58	81	10
Cubb's Isle	54	10	82	20
Bear's Islands	54	35	83	15
Parker's Dozens Isles	57	56	80	20
Sleeper's Isles	60	25	80	06
Mansfield Isle, the middle	62	20	80	30
Cape Jones	54	55	78	58
Cape Walsingham	63	00	77	55
Cape Charles	62	58	75	35
Burton's Isles	60	15	66	28
Bell Islands	52	07	54	35
Grey's Islands	50	55	53	25
Cape St. John	50	15	54	57
Penguin Island	50	15	52	57
Cape Bonavista	49	15	52	13

West Longitude

West Longitude

West Longitude

North Latitude

West Longitude

*The Sea-Coasts of Hudson's Bay, Newfoundland, and
New England.*

Names of Places.	Latitude		Longit.	
	D	M	D	M
Trinity Bay Entrance	48	28	52	14
Bacalaen Island	48	37	51	43
Conception Bay Entrance	48	05	51	58
Cape St. Francis	47	59	51	36
Cape Race	46	30	51	52
Bay of Bulls	47	40	51	45
St. John's Harbour	47	28	51	29
Cape St. Maria	47	10	53	21
Placentia Bay	47	55	53	30
Cape St. Laurens	47	25	54	23
Island St Paul	47	10	58	18
Cape Roye	48	0	57	40
Virgin Rocks	46	6	51	5
French Factory	50	10	61	10
Bay of Brest	52	10	54	57
Tadafock	49	05	64	25
Quebeck	47	4	68	15
Anti Costi Island the middle	47	35	60	45
Cape St. Charles, or Charles Straits	52	10	55	0
Cape Britain	46	10	58	30
Cape Sable	43	43	64	25
Point, or Port Royal	44	35	64	7
Penobscut River	44	40	66	20
North Yarmouth	44	8	67	45
Pascataway Entrance	43	20	68	40
Cape Ann Island	42	42	68	25
Cape Codd	42	10	68	25
Bolton Entrance	42	28	69	27
Plymouth	42	2	68	50
South End of St. George's Bank	41	25	66	52
South End of Nantucket Shoals	39	20	68	4
Nantucket Island	40	58	68	3
Martha's Vineyard	41	4	69	6

North Latitude

West Longitude

Sea-Coasts on the Main Continent in the *West Indies*.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Elizabeth Islands	41	25	69	3
Block Island	41	7	69	50
Montook Point	41	8	70	10
Fishers Islands	41	20	70	50
New York	40	45	73	45
Sandy Hook	40	29	73	48
Cape James, or Henlopen	39	5	73	46
Long Island, the middle	40	50	72	35
Cape May	39	15	73	39
Cape Charles	37	15	74	17
Cape Henry	37	00	74	25
Cape Hattaras	35	10	74	20
Cape Feare	33	32	76	55
Cape Roman, or Catrit	33	2	77	50
Ashly River, or Charles Town	32	40	78	45
Port Royal	32	00	79	43
Bay of St. Augustine	30	10	80	45
Cape Florida	24	47	81	50
Laphillapina, or Apalachia	29	47	85	40
River Spiritus Sanctus, or Mischissippi Rivers Mouth	28	54	96	50
Tompeck	22	20	100	15
Lava, or Vera Cruz	19	15	99	25
Sierra, or Cape St. de Martin	19	10	97	24
Triste, or Triest Island	18	10	94	45
Campecha	19	20	92	45
Cape Condesedo	20	50	92	10
Cape Catocha	21	18	88	50
Salamanca	17	00	92	10
Cape Honduras	16	25	87	50
Cape Camaron	16	20	86	51

North Latitude

West Longitude

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72

Sea Coasts on the Main Continent in the *West-Indies.*

Names of Places	Latitude		Longit.	
	D	M	D	M
Entrance of Nicaragua	11	15	85	15
Porto Belo	09	55	80	15
Darien, or Scotch Settlement	08	30	78	45
Cartagena	10	30	75	25
Cape Conquibaco, or Conquibaco	12	50	70	42
Island Curacao, or Quicasio	12	40	68	15
Island Margaritta	11	20	63	20
Island Trinidad	10	05	60	15
Mouth of Oronoque River	08	15	59	25
Cape Three Points	10	30	62	10
Cape Nassaw	08	25	57	55
N Cape, the middle of Caopory Island	02	05	49	55
Suranam	06	15	56	50
Cape Orange	04	05	51	25
Mouth of Amazonas River	00	00	49	55

Islands in the *West-Indies.*

Island O, the West end	11	10	59	10
Barbadoes, at Bridge Town	12	58	58	50
Granada	11	57	60	20
Granadillos	12	20	59	55
Boquia	12	50	59	53
St. Vincent	13	16	60	12
St. Lucia	14	00	60	04
Martinica	14	44	60	25
Dominica	15	25	60	30
Marigallanta	15	58	60	20
Guardulupa	16	30	61	15
Desseada	16	20	60	10
Antegua	17	25	60	35
Barhuda	17	53	60	40
Monferat	16	58	60	55
Rodondo	17	05	61	15

Islands in the West Indies.

Names of Places.	Latitude		Longit.	
	D	M	D	M
Nevis	17	10	61	50
St. Christopher's	17	25	61	59
Eustatia	17	25	62	20
Saba	17	35	62	40
St. Bartholomew	18	10	62	10
St. Martin's	18	13	62	10
Anguilla	18	17	62	12
Sambrero	18	40	62	30
Anegada	18	47	62	44
St. Cruze	17	52	63	30
Virgins	18	30	63	25
St. Thomas	18	30	63	22
St. John de Port Rico	18	30	64	56
Islands and Rocks of Aves	12	01	64	30
Tortuga, or Tortugas	11	15	63	54
Margaritta	11	20	63	20
Island Blanco	12	00	63	40
Island Testigos	11	40	62	41
Island D' Orchila	11	50	64	10
Bonaire, or Bonaire	12	22	65	58
Aruba	12	50	68	28
East end of Hispaniola	18	18	69	15
West end of the same	18	25	74	35
East end of Jamaica	18	00	75	50
Port Royal in Jamaica	17	40	76	32
West end of the same	18	08	79	00
East end of Cuba	20	10	73	55
Havana	22	40	82	55
West end of Cuba	21	40	86	30
La Bermudas	32	30	63	40
Bahama Island	27	00	79	36
Abaco South end	25	50	77	40
Andrews North end	25	12	78	50
Providence	25	00	77	20

North Latitude

West Longitude

West Longitude

Islands in the *West-Indies.*

Names of Places.	Latitude		Longit.	
	D	M	D.	M
Harbour Island	25	38	76	47
Elathera South End, <i>or</i> Ilathern	24	30	75	56
Cat Island, the middle	24	25	75	9
Watlings Island	24	3	74	35
Rum Key	23	45	74	50
Exuma	23	22	75	55
Crooked Island, North End	22	59	74	12
Long Island, South End	22	42	74	33
Atwood's Keys	23	10	73	35
Mayaguana	22	55	72	46
French Keys	22	40	73	40
Merapervouz	21	58	74	45
Hogsties	21	17	73	55
Hineago West End	20	52	73	44
West Caicos	21	20	71	58
Turks Island	21	25	70	8
Abrolho Bank, the North End	21	40	69	5
Plate Rack	20	20	68	15
Mucares	21	30	76	35
Island Verd	21	17	76	15
Cajad Zal	23	10	79	24
Island Pinos	21	20	84	20
Island great Camains	18	46	81	28
Little Camains	19	10	80	24
St. Andreo	12	12	80	18
Caimanuback	19	8	80	11
Pedro Shoals, North Side	17	10	77	55
Island St Milan	17	10	82	28
Island Guayna	16	52	88	30
Island Cozumelli	19	25	89	3
Zuna Quita	17	01	89	47

North Latitude

West Longitude

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W. or Longitude